JUNE 1961

ONE SHILLING & SIXPENCE

# FLIGHT

Aircraft, Spacecraft, Missiles

THE UNIVERSITY
OF MICHIGAN
JUL 13 1961
ENGINEERING
LIBRARY

## AIRCRAFT

The new force in world aviation

**WEATHER RADAR**
*Detects areas of precipitation to a range of 250 miles.*

**WINDFINDING RADAR**
*Measures speed and direction of winds up to 100,000 feet.*

# **Decca** meteorological radar in 50 countries

Throughout the world, Decca Meteorological Radars are being used to provide essential data on weather and upper wind speeds. Such information enables flights to be planned and routes modified in order to avoid areas of precipitation and to make maximum use of favourable winds. The result is increased operating economy, passenger comfort and safety.

**DECCA RADAR LIMITED, LONDON, ENGLAND**

DECCA RADAR

Second Class Postage Paid at N... York, N.Y.

# WIRING SIMPLIFIED TO A

RIST'S

## AND DELIVERED STRICTLY TO YOUR SCHEDULES

PREFORMED WIRING CUTS COST & SPEEDS PRODUCTION

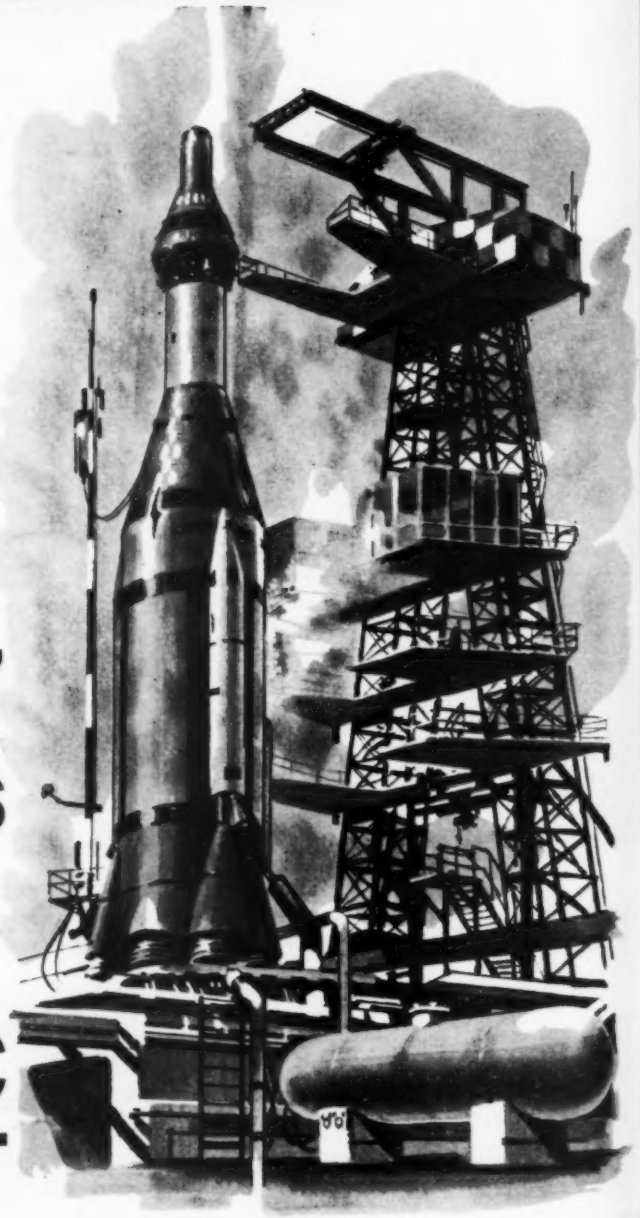
- MOULDED ELECTRICAL ASSEMBLIES
- OPEN WIRING SYSTEMS
- TERMINATED LEADS
- FOR ALL ELECTRICAL APPLICATIONS

**RIST'S WIRES & CABLES LIMITED**

NEWCASTLE · STAFFS. Stoke-on-Trent 51221/6

ELLIOTT

# AUTOMATION



brings
'space age'
techniques
to

AUTOMATIC
TEST
EQUIPMENT

# NEW AUTOMATIC SYSTEM FOR TESTING AND INSPECTING ALL COMPONENTS

## Latest method combines speed with overall accuracy

As we enter the 'space-age', the vital checking of each component in missiles and piloted aircraft alike would, without the aid of electronic computing equipment, be a task of prohibitive length.

Elliotts announce a major advance in this field by making available a range of automatic test equipment. It provides fast and accurate check-out facilities for the complex electrical and electronics systems of modern aircraft, saving enormously in time and labour.

From its immediate application to aviation problems, this new Elliott automatic test system can be used in any industry for testing and checking complete or sub-units at any stage of manufacture.

ELLIOTT

**ELLIOTT BROTHERS (LONDON) LTD.**

AUTOMATIC TEST EQUIPMENT DIVISION
AIRPORT WORKS · ROCHESTER · KENT · CHATHAM 44400

*A member of the Elliott-Automation Group*

**Have you chosen *your* career?**

Elliotts are always on the look-out for bright young science graduates who would like the chance to make some real contribution to the development of automation methods and electronic aids with prospects of progressing with a fast-expanding industry. If you think this career would appeal to you, Elliotts invite you to send their Personnel Officer a brief outline of your qualifications and interests.

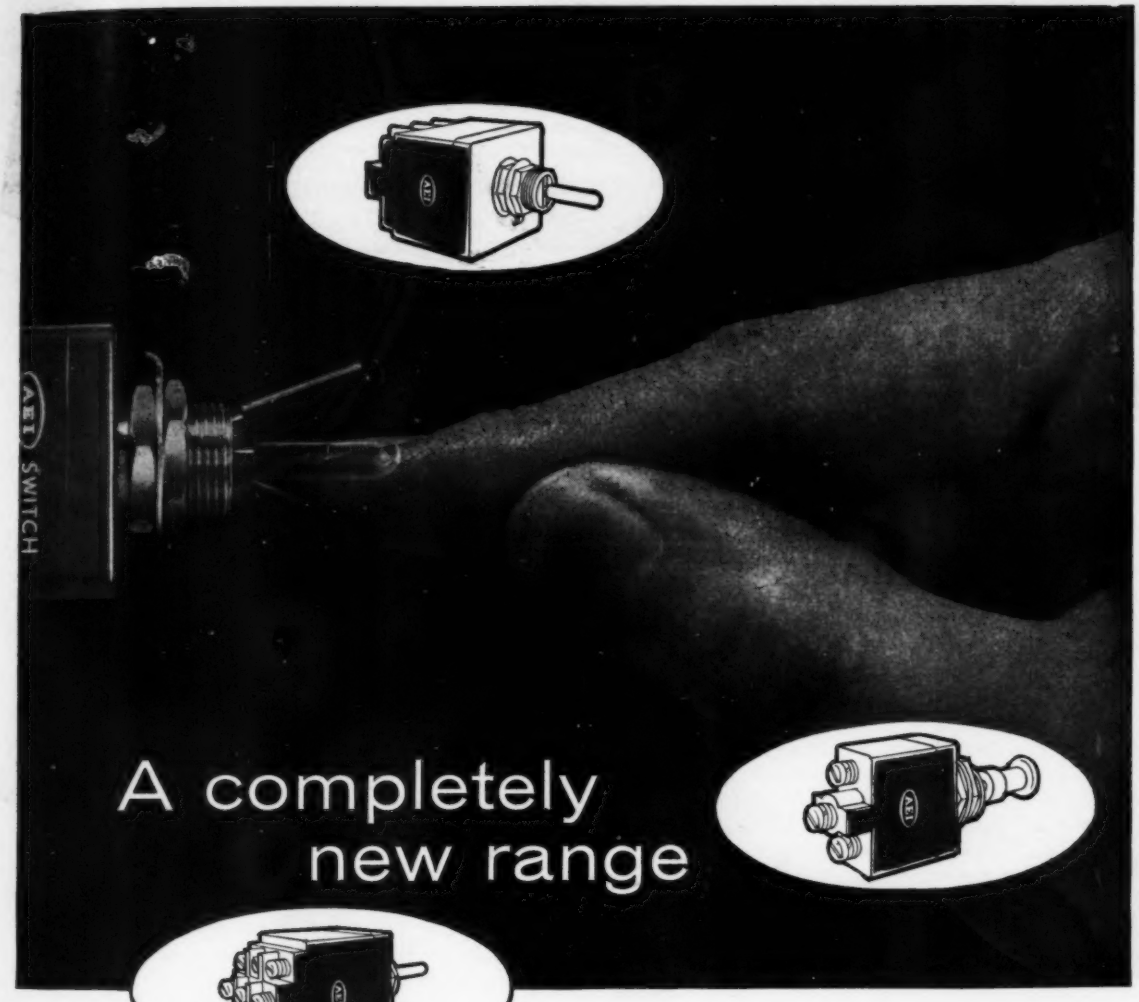
On one indicator, the Firth Cleveland Flowmeter gives the total amount of fuel consumed and the *rate* at which it is being consumed. And it will do this for one or two engines, indicating by weight or by volume. No by-pass is needed; field servicing is simple; flow transmitters are available to deal with the wide range of flows necessary in present day jet and turbo-prop aircraft.

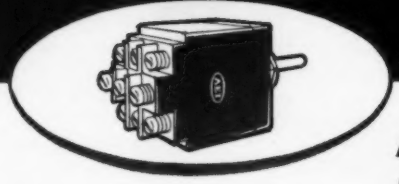
(Approved by the Ministry of Aviation)

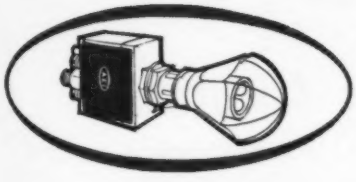
**FIRTH CLEVELAND FLOWMETERS**

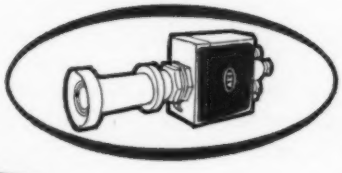
*Full technical details are yours by return of post from:*
FIRTH CLEVELAND INSTRUMENTS LIMITED, 7 CLEVELAND ROW, LONDON, S.W.1. TEL:WHItehall 3100

*A MEMBER OF THE FIRTH CLEVELAND GROUP* FC







# AEI TOGGLE SWITCHES FOR AIRCRAFT

One, two, three and four pole units rated up to 20 amperes. *Developed for* 28-*v d.c. and* 200-*v*, 400 *cycles per second*, 3-*phase circuits*. (*Fully described in Publication* 4636-81 *available on request*.)

Light in weight yet of robust construction, all switches incorporate wipe control action, double-break and are moisture-sealed.

'Pull-to-unlock' types available with latching mechanism permitting locking of switches into or out of any specified position or positions and preventing accidental operation.

Special switches can be supplied with latching mechanisms in a variety of combinations, and handles with or without lamps, to customers' requirements.

*Please address enquiries to:*

**AEI** **Associated Electrical Industries Limited**
**Aircraft Equipment Group**
COVENTRY · ENGLAND

A5594

# Avro 748

# spreads

# it's wings

## Ordered by leading Airlines

News about the Avro 748 travels fast. Leading airlines such as Skyways, BKS Air Transport, Aden Airways, and Aerolineas Argentinas have chosen this remarkable new aircraft.

The Avro 748 is ideally suited to the requirements of the short-haul operator. At low first cost it offers airlines economy of operation, more flights, quick turnround, greater profit margins.

Powered by two Rolls-Royce Dart turbo-prop engines, this hard working aircraft is extremely adaptable and versatile.

Carrying up to 48 passengers and their baggage, it can operate from existing short airfields.

Operating costs are surprisingly economical, and maintenance costs are kept to an absolute minimum by easy, speedy accessibility and the use of proven components.

All good reasons why go-ahead airlines are choosing the Avro 748. If you would like more facts—and there are plenty of them—about this truly remarkable aircraft, write to:

**HAWKER SIDDELEY AVIATION,** 32 Duke Street, St. James's, London S.W.1

No 2728 VOLUME 79 THURSDAY 22 JUNE 1961

FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded in 1909

*Editor-in-Chief*
MAURICE A. SMITH DFC

*Editor*
H. F. KING MBE

*Technical Editor*
W. T. GUNSTON

*Air Transport Editor*
J. M. RAMSDEN

*Production Editor*
ROY CASEY

*Managing Director*
H. N. PRIAULX MBE

IN THIS ISSUE

From All Quarters 852
Missiles and Spaceflight 854
NATO Air Organization 859
Super Broussard in the Air 860
Piper Cherokee in the Air 862
Sport and Business 864
All-weather Men's Farewell 867
Correspondence 871
ATCRBS 872
Straight and Level 875
Service Aviation 876
Air Commerce 877

**Iliffe Transport Publications Ltd,** Dorset House, Stamford Street, London, SE1: telephone Waterloo 3333. Telegrams Flightpres London SE1. Annual subscriptions: Home £4 15s. Overseas £5. Canada and USA $15.00. Second Class Mail privileges authorized at New York, NY.

**Branch Offices** Coventry: 8-10 Corporation Street; telephone Coventry 25210. Birmingham: King Edward House, New Street, 2; telephone Midland 7191. Manchester: 260 Deansgate 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow: 62 Buchanan Street C1; telephone Central 1265-6.

New York, NY: Thomas Skinner & Co (Publishers) Ltd, 111 Broadway 6; telephone Digby 9-1197.

© Iliffe Transport Publications Ltd, 1961. Permission to reproduce illustrations and letterpress can be granted only under written agreement. Brief extracts or comments may be made with due acknowledgement.

## Another French Lesson

LISTENING to the altercations of the Air Transport Licensing Board the other day, a member of *Flight's* staff lately returned from the Paris Show found himself reflecting that no other nation has succeeded quite so well as France in reconciling the conflicting interests of State and private-enterprise air transport, and of air and rail transport. The DC-8 services of TAI (Compagnie de Transports Aériens Intercontinentaux) across the Pacific to Los Angeles link up with Air France 707s at Los Angeles to provide a French round-the-world jet route. In 1955 UAT (Union Aeromaritime de Transport) and TAI were allotted definite shares, with Air France, of traffic to the then French African territories; more recently Air Afrique, a co-operative venture between Air France, UAT and eleven newly independent African states, was formed to continue air transport in these territories. For some years TAI and UAT have operated two of the most modern fleets in Europe. UAT began Comet services in 1953 at a time when British independent air transport was still in the York era; and France's internal airline, Air Inter, is a remarkable example of co-operation between airlines (both State and privately-owned) and French Railways. It is this same line, incidentally, which is likely to become the first operator of Breguet 942 pressurized STOL aircraft, by far the most advanced of their kind in the world.

By contrast British air transport, like the Gaul of former years, is divided into three parts: BOAC, BEA and the independents. And these divisions are all too likely to be deepened by the outcome of current applications before the ATLB. It has been well said that France is the only country in the world where if you add ten citizens to ten citizens you haven't made an addition—you've made 20 divisions. Yet it is the volatile and disputative French who have achieved a degree of airline co-operation that should make us in Britain feel more than a little abashed.

## Old Boys' Day

A LETTER in this issue from Air Chief Marshal Sir Philip Joubert expresses concern that the Air Ministry have been taking scant interest in the 50th anniversary, next April, of the formation of the Royal Flying Corps. Ventilation in the Press is suggested—a proposal which *Flight* eagerly adopts. This eagerness stems not only from past associations but also from a recognition that traditional and ceremonial observances are mainsprings and regulators of Service life. This same recognition brings us to a particular point of traditional observance. Although the Air Marshal gives April 1 as the 50th anniversary of the RFC, he has since explained that this is, in fact, the "traditional" date accepted by the "old boys" as the "opening day"—a point which may, in itself, evoke some ventilation. What is immediately important is that the Air Ministry should be thinking quickly—and big—how best to mark the anniversary.

May this leader prove as effective as (and a shade more lucid than!) that in our issue of April 20, 1912, which discussed the previous week's in these terms: "Hard on the heels of our leader in last week's issue of *Flight*, in which we attempted to set forth the Government's scheme of aerial defence as we conceived it to have taken shape in the minds of the advisers of the War Office and the manner of its working, came the issue of the official White Paper in which the intentions of those who are responsible for our defences are made quite clear. Along its main lines the Government's scheme follows absolutely our own exposition . . ."

# FROM ALL QUARTERS

## Rolls-Royce Year

AN increased profit after taxes has been announced by Rolls-Royce Ltd for 1960, £3,150,159 as against £2,634,854. In a comment on this higher figure, it is stated that favourable conditions were to some extent offset by higher charges for depreciation, for research and development, and for exceptional expenses arising from technical difficulties with the Tyne engine. (Expenditure on research and development was £7,758,274 in 1960 as against £5,660,333 in 1959.)

In his statement as chairman Lord Kindersley comments that delay in Tyne deliveries was a great disappointment, adding: "We are very conscious of the inconvenience caused to our customers and I can assure them that everything possible is being done to effect delivery of engines and spare parts at an increasing rate." Referring to the aero engine today as "a good subject for the application of the doctrine of interdependence," he adds that Rolls-Royce are making known their readiness to negotiate collaboration agreements.

## F-104 Developments

AFTER shopping in several countries for a high-performance conversion trainer for the F-104G, Western Germany announced on June 7 the purchase from Lockheed of 54 tandem-seat developments of the same aircraft, with the designation TF-104G. The Luftwaffe already has 30 Lockheed-built F-104Fs, but these cannot be used in an operational role. The TF-104G aircraft will be equipped with Nasarr and all the G model's other operational equipment, and will cost approximately £450,000 each.

On June 12 The Fairey Company announced that Avions Fairey, their Belgian subsidiary, will shortly complete negotiations as members of the Western Group of European F-104G manufacturers, which will build 389 aircraft. Together with SABCA, Avions Fairey are establishing a joint production line and flight-test facility at Gosselies, from which 194 aircraft will emerge (the rest of the Western F-104Gs will be assembled by Fiat).

Canadair, already in full swing with 200 CF-104s for the RCAF, announces a new contract for 40 sets of F-104G wings, rear fuselages and tail units which will be supplied to Lockheed for aircraft destined for West Germany. This $3m contract brings total Canadair production of these components for Europe to 161 sets, to which must be added 40 additional sets for Japan and almost $1m-worth of close-tolerance parts for European front fuselages.

## HSG Finances

ACCOUNTS published by the Hawker Siddeley Group for the seventeen months' period ended December 31 last year show that acquisition during this period of the Blackburn Group, de Havilland Holdings and Folland Aircraft has raised net assets of the United Kingdom group from £34,461,202 to £64,293,632. Net assets of the A. V. Roe Canada group attributable to Hawker Siddeley are slightly lower, £28,412,822 as against £29,331,834 at July 31, 1959. Net profit of the group for the seventeen months' period, including adjustments and after taxation, amounts to £7,771,146.

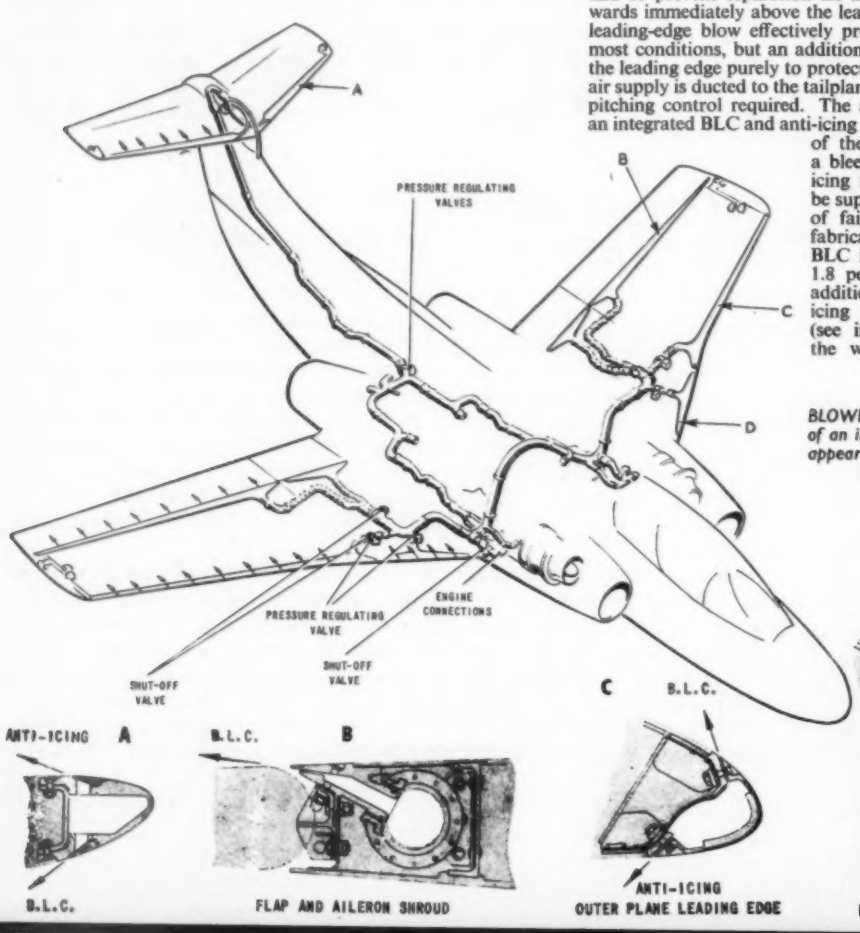
## Controlling Noise

A CONFERENCE on the control of noise is being held at the National Physical Laboratory, Teddington, Middx, from June 26 to 28. It has been organized jointly by the NPL, the Building Research Station and the National Engineering Laboratory, of the Department of Scientific and Industrial Research. Among the speakers are Prof E. J. Richards of the University of Southampton on *Aerodynamic Noise Sources* and Mr T. J. Hargest of the NGTE on *Jet Engine Noise Reduction*. Prof F. Ingerslev of the Royal Technical University, Copenhagen, is giving a paper on *Aircraft Noise and the Community*.

## BLC Anti-icing

AS briefly mentioned in *Flight* for June 1, at the 1961 Aircraft Ice Protection Conference organized by D. Napier and Son last month, a most informative paper was read by A. G. Smith and C. Jones of Blackburn Aircraft. The paper deals with Blackburn's experience in extending compressor-bleed boundary-layer control to provide protection against icing. Although the company type-number B.103 appears in the list of references, the Buccaneer as such was not mentioned; yet the illustration reproduced below bears more than a slight resemblance to that aeroplane.

According to the lecturers, Blackburn blow a sheet of air across the flaps through slits about 0.046in deep; the air issues just supersonically, and remains attached to the flap down to the trailing edge. The lift thus induced produces high suctions at the leading edge, and to prevent separation an additional 0.025in slit blows rearwards immediately above the leading edge. It was found that this leading-edge blow effectively protected the wing against icing in most conditions, but an additional 0.007in slit was added beneath the leading edge purely to protect the lower surface. An additional air supply is ducted to the tailplane in order to provide the powerful pitching control required. The accompanying drawings illustrate an integrated BLC and anti-icing system, doubtless based upon that of the Buccaneer. Full BLC requires a bleed of 12 per cent, while full anti-icing requires 5.5 per cent, which can be supplied by either engine in the event of failure of the other. Using ducts fabricated from Nimonic sheet, the BLC installation imposes a penalty of 1.8 per cent of the gross weight, the additional weight of the purely anti-icing slits on the pressure surfaces (see inset drawings) and inboard on the wing being about 0.2 per cent.




*BLOWING ICE AWAY: these illustrations of an integrated anti-icing and BLC system appear to depict the system used on the Buccaneer (see text above)*

## Bedfordshire Air Centre Opened

DECLARING open the Bedfordshire Air Centre at the College of Aeronautics aerodrome at Cranfield last Saturday, Mr Peter Masefield said that general aviation in Britain must campaign for four main objectives: (1) more airfields and landing grounds, (2) more training facilities, (3) the right aeroplanes—whoever made them, and (4) a liberal but responsible approach to the problems of airspace. Chairman of the Centre is Mr N. A. Rogers, whose company, W. H. and J. Rogers (Engineers) Ltd, is regional dealer for Cessna. The initial fleet of the Centre comprises a Tiger Moth, an Auster and a Cessna 150. Manager and CFI is Mr R. D. Campbell, and the Centre's two instructors are Miss Pamela Klein and Mr A. J. McDonald.

## Lighter-than-air Lifetime

*Mr G. E. Long*

BEHIND the bald official announcement of a name in the Honours List there sometimes lies a story of very considerable interest. An example from the recent Birthday Honours, under the heading "British Empire Medal (Civil)," was the entry "George Ernest Long, non-technical Grade II, Royal Aircraft Establishment, Cardington."

Mr Long, who is retiring this year at the age of 67 after 52 years in Government service, is the only licensed civilian balloon pilot in the country. He joined the Civil Service in 1924 after service in the armed forces dating from 1913. In March 1914 he became a qualified balloon pilot, a distinction he has retained ever since.

Throughout the First World War he served in RNAS airships, both rigid and non-rigid. After the war he had a period of service with flying-boats and then, in 1924, was demobilized, whereupon he returned to airships as a civilian. Serving in R 33, he was awarded the AFM for his part as civilian coxswain on that airship's "break-away" flight over the North Sea. In 1926-29 he continued with maintenance duties on R 33 and with high-altitude kite-balloon experiments, and he was 1st civilian coxswain in R 100 during her flight to Canada in 1931.

From 1931 to the outbreak of World War II Mr Long went on with his kite-balloon work, and he was concerned with balloon-barrage impact trials at Portland, Larkhill and Lakenheath in the immediate pre-war years. Throughout the war he was occupied with lighter-than-air craft in responsible posts, and ever since then he has been stationed at Cardington, where the RAF has carried on work of this kind on a limited scale.

## Horticultural Helicoptery

SEVENTEEN helicopters went to a garden party in Surrey last Saturday. It was the annual RAeS Rotorcraft Section outing in the lovely surroundings of Dunsborough Park, Ripley, home of Mr and Mrs Charles Hughesdon. More than half the visitors were in uniform: three Skeeters and two Alouettes from the Army Air Corps, which departed in Guards-like formation; Sycamore, Whirlwind and Belvedere from 225 Sqn, RAF Transport Command; and RN Whirlwind and Wessex from the A&AEE.

The seven civilian visitors were a Bell 47G-I of Air Couriers; Hiller 12C of Bristow; BEA Whilrwind; two Widgeons from Westland; and two interesting newcomers, an amphibious Sikorsky S-62 of World Wide Helicopters with nine-seater passenger cabin, and a smart Hiller E-4 which was *en route* for the Trieste Fair and will afterwards be delivered to Germany. BUA have bought 12, six for use in South Africa and six in South America. A ride given to *Flight* behind Hiller test pilot Frank Huglin (the seating is in one-three configuration, with dual controls in the port side passenger position) created a good impression, with low noise and vibration levels. This was the carpeted executive version; BUA have ordered the work-horse three-seater.

*HSA PRODUCTION MANAGER: Mr R. A. Courtman, formerly senior executive at AWA, will be responsible for production co-ordination at all Hawker Siddeley Aviation operating companies and will be based at Kingston-upon-Thames. His duties at Coventry are being taken over by Mr G. E. Hayward*

## USAF "At Home"

FIVE USAF bases in the United Kingdom—Sculthorpe, Wethersfield, Alconbury, Bentwaters and Mildenhall—opened their gates to the public last Saturday, Armed Forces Day. *Flight* visited two of them, Wethersfield and Alconbury, our correspondent at the former (Headquarters of the 20th Tactical Fighter Wing) reporting that "partners for peace" was the day's theme. The programme (he writes) was "bigger, better and noisier than ever before. Low cloud restricted the Skyblazers and Blue Diamonds to their horizontal displays and poor visibility made things difficult for them. 92 Sqn's team has not yet become as well-known as Treble One's Black Arrows: their display is largely original, with much use made of aircraft breaking away (trailing smoke) at unexpected moments. It finishes with a fan break during which each aircraft rolls individually. An F-100 did a simulated LABS run, the bomb burst being simulated by a buried 40gal drum filled with nitro-glycerine, napalm and smoke bombs. A Spitfire/Hurricane dog fight was followed by parachuting and a series of interesting items which included a Jato-assisted T-33 take-off and a Century-series formation—F-100, F-101, F-102 and F-104. In contrast the Tiger Club presented three Turbulents."

At Alconbury, where about 34,000 people attended (in contrast with around 50,000 at Wethersfield) a highlight of the flying was a formation of five Fouga Magisters of L'Ecole de L'Air, making their first appearance in the UK. Alconbury had its own RB-66s of the 10th Tactical Reconnaissance Wing flying in the display and also a Victor and a Valiant. The latter fired off two red flares when coming round for its fly-past, then a green and another red one before it departed. This was a deliberate display of pyrotechnics, not due to any emergency.

## Colour at Elstree

ELSTREE was lucky in its weather for the London School of Flying display and pilots' rally on June 18: a warm afternoon with blue-sky-and-white-cloud background, setting off well the graceful red wings of Geoff Wass's Skylark, the clerical black-and-white of Nepean Bishop's Archbishop Tiger, the pink and white of Martin Griffiths' parachute (landing accurately on the grass runway), the silver of Duncan Simpson's gallant old Hart, and the camouflaged shapeliness of David Morgan's Spitfire ("worth coming all the way just to see that," as one enthusiastic spectator put it).

Things got off to a good local start with co-ordinated flying by five Chipmunks of the London and Midland Schools of Flying; then Elstree's deputy CFI, Mike Buxton, gave a good demonstration of the Chipmunk's aerobatic qualities and David Greenland showed what could be done behind a well-tuned Volkswagen engine in a Tipsy Nipper. There were 39 visiting aircraft, a range of types representing six different countries.

## IN BRIEF

Mr R. J. Cooper has been appointed to the board of Fairey Air Surveys Ltd. He is group personnel and insurance manager of the holding company, The Fairey Co Ltd, an appointment he retains.

Five Tiger Moths flown by RAF Section members of the Combined Cadet Force at Eastbourne College were making a fly-past over the school's parade ground last Monday during the annual CCF inspection, at which the inspecting officer was the Duke of Norfolk.

The Students' Society of the College of Aeronautics is holding its presentation ball at Cranfield on Friday, July 7. Tickets (£3 double) are obtainable from the secretary of the ball committee, Mr B. Rodgers, at Leicester Hall, College of Aeronautics, Cranfield, Bletchley, Bucks.

A Grumman Gulfstream—N358AA, the demonstrator which appeared at the Paris Show—was used last week to take the Duke and Duchess of Kent to Majorca for the second part of their honeymoon. It had been chartered from Atlantic Aviation Corporation through their European distributors, G & M Air Interest Ltd of London.

Today's (June 22) issue of *The Motor Cycle* is the T.T. Report Number, third of the three special issues covering the Tourist Trophy Races in the Isle of Man.

*NOT A P.136 on the water, but a P.166 on the grass. With owner Lord Derby on board, it had damaged a wheel on take-off; the pilot, Sqn Ldr M. Wainwright, radioed Luton Airport for advice; and Capt Ray Young of McAlpine Aviation assured him of the Piaggio's amenability to a belly landing. So nobody got hurt, and G-APVE was only slightly damaged*

## Missiles and Spaceflight

# MISSILE RELIABILITY

BY A CORRESPONDENT

THE elements that make for success in the development of a major defence system, such as Thor, Atlas and Titan, were outlined recently by a group of men best qualified in the United States to discuss the subject. They spoke before the annual meeting of the Aviation/Space Writers Association in New York last month. Leading the discussion was Lt-Gen B. A. Schriever, newly appointed chief of the USAF Systems Command, who told the writers that, while "flight tests are glamorous and certainly conspicuous," they are analogous only to that part of an iceberg that we see above the surface. For every flight test there are many more development steps, plans, actions, designs, confirmations and design changes which in total make or break a new missile programme.

Gen Schriever noted that the Germans had found it necessary to test a great many V-2s before they got a workable design. Today's missiles, which were much more complex, might require 10,000 flight tests if they were to be proved in the same manner. Yet, missiles such as the Titan and Atlas were proven for operational use after only a few dozen test flights. "To achieve the performance that would be gained from the other 9,900 test flights, a series of steps must be taken during the development of a new missile to measure its anticipated performance indirectly and thus avoid the trial-and-error, 10,000-flight method," Gen Schriever said.

This is part of the programme of concurrent development, better known as concurrency, which Gen Schriever has fostered in the development of missiles and without which, in his words, "a priority weapon system cannot be developed today." He further defined concurrency as carrying on simultaneously the research and development effort for a new missile, its operational planning, logistic support and the training of operational personnel.

"Concurrency," he told his audience, "puts a premium on being technically correct," and he cited the Thor programme as a good example of what can be done. "Thor was on the stand for first launching within a year after inception of the programme, and in operational sites ready for firing by military personnel in three years," he said, and then added: "Today the reliability and readiness of these missiles exceed that of manned bombers."

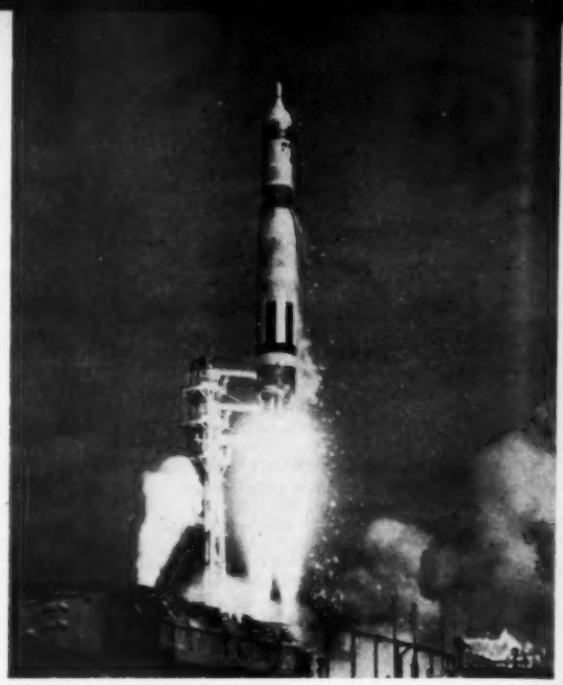
J. R. Dempsey, president of the Astronautics Division of General Dynamics Corp, who directed the Atlas missile programme for that company, explained how the principle of concurrency was employed in the development of Atlas. "Our team had to make decisions on a missile that was still many months away from its first test flight—it was a good deal like betting a poker hand in the dark until the fifth card."

"But the concept has paid off," said Mr Dempsey, "and one of the reasons is that we hedged our bets with an intensive reliability programme that has been a basic part of our work on Atlas from the very beginning."

He indicated that the reliability programme had been accomplished in two principal phases: First, by defining in the early design stages those areas which seemed most likely to give technical trouble. Intensive theoretical and applied analyses were made of those areas so that information would be available to designers as they worked out details of the actual hardware. Second, the reliability programme was set up so as to evaluate each bit of technical experience as Atlas was developed and proven on the test stand, and this evaluation was then pumped upstream to manufacturing and design phases so that it could be worked into all new production. As a result, declared Mr Dempsey, about a third of the 25,000 employees of GD-Astronautics were engaged at one time or another in some form of testing or quality control.

The permanent reliability organization at GD-Astronautics consists of 116 people, divided into two groups. The first is Human Engineering, where psychological studies of man-machine relationships are made to anticipate and avoid the design of machines or procedures that run contrary to human behaviour. The second is a Reliability Diagnostic Laboratory where critical weakness tests are made. New components not yet used on a missile system are tested under appropriate environmental conditions and the information is fed to design engineers. And, when something already installed in the missile system does not perform as it should, the components may be funnelled back through this laboratory.

Failure-analysis reports are handled promptly, with feedback to all interested parties for immediate corrective action. There is even a follow-up system. When action is not taken within the prescribed time, a report goes to top management, which sees to it that appropriate action is taken.



*End-product of missile reliability: a perfect launch from Cape Canaveral (Titan G8 with Avco RVX-3 nosecone, September 29, 1960)*

Mr Dempsey cited several examples of the detailed, precise reliability standards that were being used in connection with Atlas. "Even cleanliness has its reliability standard," he noted, "for the requirements of missiles in this respect in some ways surpass those of the human system. Fluid systems on Atlas are chemically cleaned and inspected by black light, which makes impurities glow for easier detection. Hydraulic and fuel systems are not up to standard if impurity sizes exceed 175 microns in the fuel system and 30 microns in the hydraulic system. We are working with mere specks, and maintaining cleanliness standards which surpass those of most hospital operating rooms to assure reliability," he said.

Mr Dempsey noted that 81 Atlas missiles had been fired for the US Air Force as of April 10 and, of these, 53 were totally successful, 20 were partially successful, and only eight were totally unsuccessful. He said the results to date "demonstrate the painstaking effort that goes into each missile long before it reaches the test base."

Test launches yield a vast amount of information that is fed back into the reliability programme. Each test launch provides about two and a half miles of data recorded on magnetic and paper tape. Before an Atlas test flight is made, 145 measurements are transmitted from the missile to recorders by land lines. After launch, 185 measurements are taken, 32 continuously throughout the flight and the rest intermittently. The intermittent readings provide over 600,000 data points. Recorded at Cape Canaveral, the data then is flown to San Diego and within 24 hours the design engineers meet to review each significant element of the missile and its performance during flight. Therefore, in little more than a day after a test flight, GD-Astronautics personnel can be working out improvements for subsequent missiles.

Dr Harold W. Ritchey, vice-president of the Thiokol Chemical Corporation, a leading producer of solid propellants and rocket engines, discussed some aspects of reliability as related to missile propulsion systems. He began by saying that reliability was only one of four problems a manufacturer faced in producing systems for the armed forces. In addition, cost, performance and schedule must be given equal attention. If costs were too high, funds might be exhausted before a system was ready; if performance did not meet requirements the system might not gain acceptance; if schedules were not met or surpassed the system might be obsolescent before it was ready. "We literally are on a tightrope, trying to balance the four elements as we go along," declared Dr Ritchey. "However, the task of balancing these four factors can be greatly simplified by extensive test programmes on the components, on each sub-system as it is developed, and finally on the propulsion system itself. Then we no longer need to walk a tightrope, but instead can make our way along a bridge that has some width."

Almost any degree of reliability was attainable at cost, declared Dr Ritchey, who illustrated his point with some reliability-cost curves. However, he added, the dollars spent to achieve a certain degree of reliability for any given system would be less if, in the early stages of the programme, an extensive test programme to

develop and improve component reliability was put into effect. While overall expenditures might be higher in the early part of the programme, he concluded, the total amount of money spent by the end of the programme would be less (see reliability and cost curves below).

As for what made reliability easier to gain in one propulsion system compared with another, Dr Ritchey listed two major items. First, the less reliable system might have more components, thus increasing the number of separate elements of the system that could go wrong. A more complex system would require a more extensive testing programme in the development phase. Second, the less reliable system might have been designed closer to the limits of existing knowledge so as to achieve the required performance, and therefore would include a higher proportion of unknown factors.

In a frank claim for the greater reliability of rocket engines employing solid propellants, Dr Ritchey cited the reliability history of three different rocket powerplants—the XM-20 solid-propellant engine used as the first stage of the X17 re-entry test vehicle, the XM-55 solid-propellant engine to be used in the first stage of the Minuteman missile, and the LR-89 liquid-fuel engine used in pairs in Atlas (see Table I).

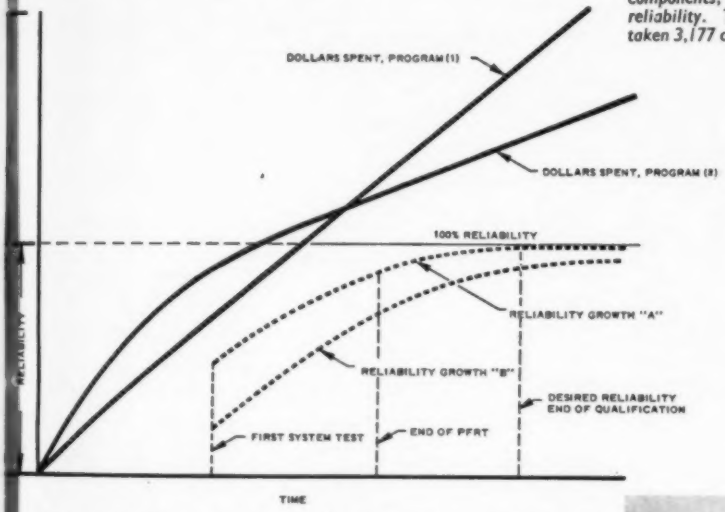
Dr Ritchey showed how the XM-20, with only six components, achieved a demonstrated reliability of 95.7 per cent after only six pre-flight rating tests. "Following these six static tests," said Dr Ritchey, "a total of 39 flights was accomplished with no recorded failures attributed to the propulsion system. Since that time, this engine with certain modifications has been used extensively in the Polaris test vehicle programme, the NASA Little Joe and Scout programmes, and in the Argus launches. More than 100 flights have been launched with no propulsion failures."

**TABLE I: RELIABILITY RECORDS FOR THREE ENGINES**

| | XM-20 (X17-RTV) | XM-55 MM-Wing 1 | LR-89 Atlas |
|---|---|---|---|
| (1) Number of components | 6 | 9 | 33 |
| (2) Number of complete engine development tests | 6 | 132* | 3,177 |
| (a) Engineering development and storage tests | 1 | 82* | 3,126 |
| (b) Preflight rating tests | 5 | 12 | |
| (c) Qualification tests | 0 | 18* | |
| (d) Development flight tests | 0 | 20* | 51 |
| (3) Accumulated running time to date | 1,220 sec | 2,350 sec | 155,750 sec |
| (4) Total flight tests to date | 39 | 1 | 74 |
| (5) Flight failures due to 1st stage propulsion | 0 | 0 | 4 |
| (6) Reliability demonstrated (90% statistical confidence) | 95.7 | 90.5 | 91.4 |

* Projected to completion of first operational wing.

*The above compilation of test data for two solid-fuel rocket engines (XM-20 used in the X17 re-entry test vehicle and the XM-55 for first-stage Minuteman) and one liquid rocket engine (LR-89 in Atlas) show how many more tests must be run on more complex engines to achieve reliability compared with a simpler engine. The XM-20 with six components required only six complete engine development tests to achieve a reliability of 95.7 per cent, whereas the XM-55, with 50 per cent more components, will require 132 tests to achieve an estimated 90.5 per cent reliability. The LR-89, on the other hand, with 33 components, has taken 3,177 complete engine development tests to turn in a performance of 91.4 per cent reliability*




**RELIABILITY AND COST CURVES**

*Two different but typical situations are depicted by curves A and B. Both show an improvement in reliability over a period of time*

Reliability growth curve A might be based on a simple system with a minimum number of components, or a system designed rather conservatively to assure performance. B, in which lower reliability is experienced, may have more components than A, or possibly B had to be designed more closer to the limits of existing knowledge in order to obtain necessary performance.

The upper curves depict the manner in which money may be spent during the course of a particular development programme. Curve 1 is linear, and shows spending during the course of a development programme relative to the degree of reliability attained in either System A or System B. Curve 2 shows spending of greater amounts early in a programme, primarily for extensive testing to develop and improve component reliability. Because of these early outlays, the same degree of reliability is attained by the end of the programme with a smaller outlay.

Together, these charts show that almost any degree of reliability can be attained at a cost in time and money, and that such costs must be weighed carefully against the need for a higher degree of reliability in the system.

The XM-55, with nine components (50 per cent more than the XM-20) would go through 132 complete engine development test flights and achieve a reliability of 90.5 per cent by the time one operational wing of Minuteman missiles had been completed, Dr Ritchey estimated.

The LR-89 liquid-fuel engine for Atlas had achieved a reliability of 91.4 per cent to date, but had required 3,177 complete engine development tests to demonstrate that degree of reliability. The LR-89, as noted previously, had 33 components, "and as components increase," declared Dr Ritchey, "the number of tests must go up geometrically to achieve the same degree of reliability as for an engine with fewer components."

Dr Ritchey noted that, in the XM-55 engine development programme for Minuteman, "There have been a number of component failures consistent with the usual experience in solid engine development" and with the fact that the engine had a high degree of design sophistication. Once satisfactory designs were achieved, no significant failure was experienced in 23 subsequent tests. To date, some 178 tests had been run on the combustion chamber of the XM-55 engine for Minuteman, 196 on the nozzle, 1,260 on the liner and insulation, 2,125 on the ignition system, and 57,756 on the propellant. The large number of propellant tests included numerous small engine tests for propellant ballistic and environmental evaluation, physical property tests on propellant samples,

(*Concluded on page 858*)

*The other side to the coin: failures are inevitable in development, and sometimes spectacular (fifth Titan, August 14, 1959)*

## Missiles and Spaceflight . . .

# US Space Programme Detailed

**THE new American goals in space, announced by President Kennedy on May 25, involve major changes of emphasis and increased spending in the programmes of the National Aeronautics and Space Administration. These changes are detailed in this statement by NASA Administrator James E. Webb, supplementing our first report on June 1.**

IN the words of President Kennedy's new message [says Mr Webb] as they relate to space: "Now it is time to act, to take longer strides—time for a great new American enterprise—time for this nation to take a clearly leading role in space achievement. . . . I believe that the nation should commit itself to achieving the goal, before the decade is out, of landing a man on the Moon and returning him safely to Earth."

This major new national goal set by the President requires a very large launch vehicle, for which development of alternative liquid and solid-fuel boosters will be carried forward; and a lunar spacecraft together with the requisite supporting research and development, facilities, and preparatory and exploratory missions.

Other national goals established by the President are (1) an accelerated development of the Rover nuclear rocket; (2) early use of Earth satellites for worldwide communications; and (3) early realization of a satellite system of worldwide weather observation.

In perspective, this means that the original FY 1962 authorization request for the National Aeronautics and Space Administration submitted by the previous administration in the amount of $1,109,630,000 is now increased to $1,784,300,000, or by 61 per cent. The first request of President Kennedy for an increase in the NASA budget on March 28, 1961, was for $125,670,000. His second request submitted on May 25 is for a further increase of $549m.

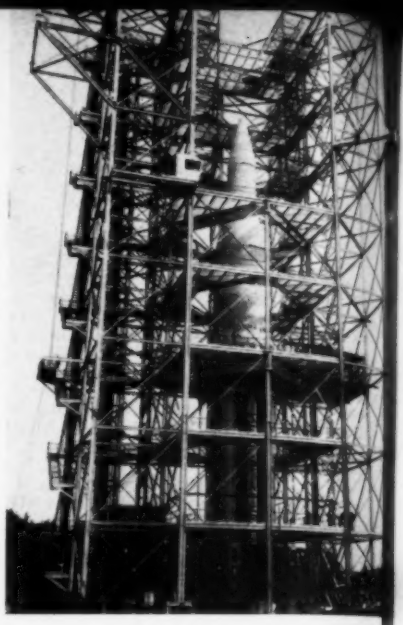
On the expenditure side, it was estimated that the NASA programme submitted by the previous administration would result in expenditures of $965m for fiscal year 1962. As a result of the two increases submitted by this administration, expenditures are now estimated at $1,380m, or an increase of 35 per cent.

On March 28 I advised that the earlier decision would result not only in increased expenditures in the fiscal year 1962, but also a higher level of expenditures in future years. An understanding of the long-term effects of the President's recommended increases is important. Future-year expenditures will increase much more rapidly and reach much higher levels than we as a nation have previously committed ourselves to invest in the exploration of space.

### Lunar Projects

You will recall that the first augmentation by President Kennedy was primarily for the purpose of speeding-up the booster and propulsion components whose development must precede an expanded programme of manned and unmanned exploration of space. Further increases in this area, aggregating some $144.5m, are included in the requests made by the President today. Included is the initiation of a Nova vehicle of very large thrust, with sufficient power to land men on the Moon and return them to Earth. The increased request also provides an additional $130.5m for Apollo, which will lead both to a three-manned Earth-orbiting laboratory and a manned lunar landing spacecraft. A sum of $66m is requested for an accelerated effort in research and exploration of the environment around the Earth, around the Moon, and in the space between. Funds are provided for a study of the problems of return to Earth from flights around the Moon at re-entry speeds up to 25,000 m.p.h., which will generate extreme heat. Thorough studies of radiation problems will be conducted, including an analysis of solar activity over the past 50 years in order to predict, if possible, the periods of extreme radiation which man must avoid.

In the original budget revision requested by the President, $10m was included to take full advantage of the potentialities of an operational communications satellite for both industry and government. This addition postponed the necessity for industry financing of research and development until a firmer base of government policy could be laid. Negotiations are now being conducted with the American Telephone and Telegraph Co for co-operation with that company in the most rapid possible development of its plans for experimental and development flights of satellites built at its own expense. Also, the Radio Corporation of America has been selected for the negotiation of a contract to build for NASA an experimental communications satellite, known as Project Relay, to study radiation effects on solar cells, transistors, and other components and to demonstrate trans-Atlantic television. Concurrently, the Federal Communications Commission has been taking steps to establish the necessary regulatory and licensing policies for an operating entity for a commercial system. In President Kennedy's new request, there is an additional item of $50m to expedite this development and to bring into being the kind of system needed to meet governmental as well as commercial requirements.



*Seen in the Saturn dynamic test stand at NASA's Marshall Space Flight Center, Huntsville, is a three-stage version (with dummy second and third stages) of the Saturn C-1. This stand will permit the check-out of mechanical mating features; determination of natural bending characteristics, and effects of low temperatures and vibration; and it will hasten crew-training*

In the area of meteorological satellites, there is an increase of $22m to expand the Tiros flight programme, and, in addition, the President has requested $53m for the Department of Commerce to enable the Weather Bureau to proceed without delay toward the development of a worldwide meteorological satellite system based on the Nimbus satellite now under development by NASA as a follow-on to the Tiros series.

In connection with NASA's programme of speeded-up research and development of liquid-propellant engines, an additional $15m is provided to accelerate the 1,500,000lb-thrust F-1 engine programme, and $58m is provided for long lead-time propulsion-development facilities, such as static test stands for single and clustered engines; facilities for testing booster stages powered with clustered engines; and design of new launch facilities for the much larger flignt vehicles to come in support of the manned lunar effort. The largest booster vehicle which is funded in this programme is the Nova; $48.5m is provided to start work on a liquid-fueled Nova flight vehicle.

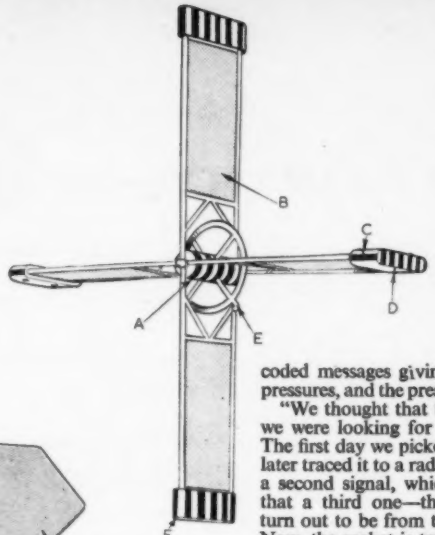
The Department of Defense, through its Minuteman and Polaris developments, has great capability in the field of large solid-propellant rockets. Therefore, solid-propellant booster stages for the Nova vehicle will be developed by the Department of Defense in parallel with NASA's liquid-fueled stages. The Department of Defense budget will include $62m to begin work in fiscal year 1962. This means that both of the liquid- and solid-propellant technologies will be driven forward at the rapid rate needed to assure the earliest availability of a Nova vehicle. As soon as the technical promise of each approach can be adequately assessed, one will be selected for final development and utilization in the manned space programme. The Department of Defense budget will also include $15m for a back-up launch vehicle based on Titan II.

An important item in the new requests is that of $12m for launch-vehicle technology, which includes $8m more for orbital rendezvous or docking experiments with Atlas-Agena vehicles.

Included in the requests is $23m additional for the Rover programme for NASA's share in the co-operative NASA-AEC project looking toward a nuclear rocket engine. This includes $15m for engine-test facilities which should be started now in order to achieve the earliest feasible flight date.

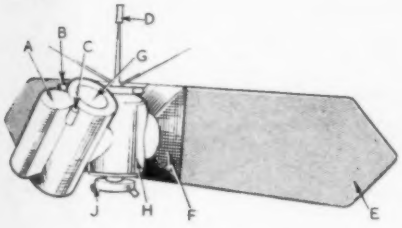
From the above it is clear that the President's requests, taken as a whole, established a pattern of effort that adds up to a vigorous, well-rounded national space programme. There is wide participation by many departments and agencies. This programme, in order to be successful, will require a sustained and highly paced national effort over a number of years. The President's action today not only steps up the programme for the first year but also contemplates an increased tempo for future years. A research and development programme of this nature will require quite large appropriations for construction of facilities in the early years.

Of the $143m included in the President's requests for additional facilities, I have already mentioned the $58m for the Nova test and launch facilities, and the $15m for the nuclear-rocket development facilities. We have also included $60m for expansion of manned spaceflight facilities and $5m for another tracking station to extend our world-wide network. At previous conferences on the 1962 budget, we covered the substantial facility requirements for other parts of the NASA programme, such as those of the Marshall Space Flight Center and the Atlantic Missile Range.




*The second model exhibited at the RAE, sketched on the left, depicted the design of a satellite suitable for worldwide commercial communications. The main items illustrated are: A, fuel tank; B, solar batteries; C, attitude control jets to keep satellite pointed at Earth; D, communications packages; E, device for damping attitude oscillations; F, horizon seekers for attitude sensing. Another RAE Open Day exhibit is described in "Transit Station at Lasham" on this page*

"Flight" copyright drawings.




*These two satellite designs were shown in model form at the recent Open Days at the Royal Aircraft Establishment, Farnborough. Below, this astronomical satellite comprises: A, spectroscope; B, X-ray detector; C, television camera; D, attitude control jets; E, solar batteries; F, telemetry, data storage and aerials; G, astronomical telescope; H, control equipment; J, star trackers for attitude measurement*

## TRANSIT STATION AT LASHAM

One of the ground-tracking stations in the worldwide Transit satellite network is at Lasham Aerodrome, Hampshire, and is operated by the Radio Department of the Royal Aircraft Establishment, Farnborough. During the Establishment's recent Open Days an exhibit in the Guided Weapons Department gave a novel practical demonstration of the functioning of this unit.

The demonstration showed one possible use of a Pegasus digital computer in solving the complicated equations arising in satellite work. The determination of orbits (from known ground positions) and ground position-fixing (from given orbits) are complementary uses of the same fundamental relationships, and on this occasion the Pegasus programme had been arranged to determine the position of the Lasham radio receiver from signals received from the US Navy's Transit 2A satellite.

This satellite transmits on a constant frequency of 54 Mc/s, while the signal received at Lasham is changing continuously because of the Doppler effect. The Doppler frequency, or difference between 54 Mc/s and the received frequency, is proportional to the rate of change of the satellite's distance from the ground station, and in the RAE demonstration this Doppler frequency was passed along telephone wires to Farnborough. Here the Doppler cycles were counted and passed, once every second, to the Pegasus computer.

The computer, previously supplied with details of the known motion of the satellite and an approximate estimate of the position of the receiving station, then used the Doppler information to obtain an improved estimate of the position of the station. In a practical system the ground receiver would be combined with a special-purpose computer in a single compact unit suitable for installation in a ship or mobile van.

## VENUS PROBE REMAINS SILENT

Prof Alla Masevich and Dr Jouli Khodarev left Jodrell Bank on Friday last, June 16, after a week of unsuccessful attempts to contact the Soviet Venus probe using the Manchester University station's large steerable radio telescope. The two Russian scientists had been working with Prof Sir Bernard Lovell, director of the Nuffield Radio Astronomy Laboratories and professor of radio astronomy at Manchester University; Dr J. G. Davies, University reader in radio astronomy, and other members of the Jodrell Bank staff in these experiments. Prof Masevich is well-known in this country as head of the Soviet satellite-tracking network, and Dr Khodarev is believed to have been concerned with the design of the electronic equipment in the tracking stations used in connection with the Venus probe.

At a press conference before leaving Jodrell Bank, Prof Masevich said that, since the last successful reception of signals on February 17, the probe had not responded to ground commands and was probably responding to instructions from an automatic computer on board. She continued: "Nobody knows what has caused the trouble. Perhaps it has been struck by a meteorite, possibly it has changed its orbit. There may have been some mechanical failure, or something may have gone wrong with the receiving system. It was designed to transmit signals every five days. For about 17 minutes it should have sent out an unmodulated sound, and then transmitted coded messages giving scientific information such as temperature, pressures, and the presence of meteorites.

"We thought that the transmission time might have changed, so we were looking for signals all the time it was over the horizon. The first day we picked up something which sounded like it, but later traced it to a radio station near Jodrell Bank. Then we received a second signal, which also came from Earth. Our only hope is that a third one—the source of which is still unidentified—may turn out to be from the rocket. It is coming in short modulations. Now, the rocket is travelling almost a million miles a day, and any hope of contact has almost completely gone."

Tape recordings of all the relevant signals received at Jodrell Bank during the attempts to contact the probe were taken back to Russia by Prof Masevich and Dr Khodarev for further analysis.

---

The USAF Discoverer 25 satellite was successfully placed in orbit from Vandenberg Air Force Base, California, on June 16.

The USAF has ordered 22 DM-21 Thor rockets from Douglas for use as space boosters. The DM-21 has a shorter, lighter airframe than earlier versions and has a 165,000lb thrust engine compared with the previous 150,000lb MB-3. The boosters will be used in Discoverer, Transit, Nimbus and other firings.

The Nike Zeus target-tracking radar installed at Ascension Island had its first operational test on May 27, when it followed the trajectory of the re-entry vehicle of an Atlas launched from Cape Canaveral. As described in our January 20 issue, a more complete complex is being constructed at Kwajalein, for live interceptions of ICBMs launched down the Pacific Missile Range.

It can now be divulged that the revised GAM-87 Skybolt ALBM, illustrated in last week's issue, is 38ft long and has a launch weight of 11,302lb, some 140lb less than before modification. According to unofficial American reports, the missile rolls through 180° after release from the parent aircraft, to allow the Nortronics star-tracker to "see" the upper hemisphere.

After inspecting the site, General L. S. Kuter, US Air Force, said in London on May 30 that the BMEWS tracking station at Fylingdales "is going according to plan." He said that it would eventually be necessary to extend the BMEWS system to detect and track the re-entry vehicles of missiles launched from more than half-way around the Earth; but he thought a more pressing requirement was for an interception system capable of destroying ALBM launch aircraft at great distances. Gen Kuter is Commander of the joint US/Canadian North American Air Defense Command.

During the past year the US Navy has been investigating the practicability of firing a ballistic missile floating in the open sea. The test programme took a big step forward on April 19, when a test mock-up, named Hydra 2, was successfully launched near San Clemente island. Weighing 20,000lb, it was a boilerplate model with a cut propellant grain. A spokesman at Pt Mugu said afterwards, "Our tests have proven that an object of nearly any weight can be sea-launched a distance limited only by the power of its propellant. We are now ready to move to the useful-application stage."

*On duty at Jodrell Bank last week (see "Venus Probe Remains Silent"): from the left, Dr J. G. Davies, Prof Alla Masevich, Dr Jouli Khodarev and Sir Bernard Lovell, director, Nuffield Radio Astronomy Laboratories*

## Missiles and Spaceflight . . .

# MISSILE RELIABILITY (continued from page 855)

and many XM-55 sub-scale engine tests conducted for design information (see Table II).

Both destructive and non-destructive tests had been performed on some of the engine's components, such as the combustion chamber. During the initial stages of chamber fabrication, a quantity of sub-scale and full-scale chambers were subjected to destructive tests to obtain processing and quality information. In addition, all combustion chambers intended for full-scale engine fabrication were subjected to non-destructive functional tests (such as hydro-testing) prior to use. The number of tests shown in the table of XM-55 component tests probably will double by the time the engine's qualification test programme has been completed. Using Gen Schriever's analogy to the iceberg, Dr Ritchey indicated that the actual flight tests of the XM-55 solid propellant for Minuteman will account for only ten per cent of the total engine development cost. The other 90 per cent (which, like the iceberg, are not readily apparent), include five per cent for initial design and analysis, 30 per cent for component testing, and 55 per cent for engine static tests.

### Electronic Units

Col William H. Congdon of the USAF's new Electronic Systems Division at Hanscom Field, Bedford, Massachusetts, told the group that designers must frankly "employ redundancy of components, circuits and sub-assemblies" in electronic gear to achieve reliability. To get good reliability at low cost, he recommended duplexing so that two or more parallel but less expensive units were employed instead of one very expensive but very reliable unit. "This technique is appropriate to electronic systems which contain common items such as computers, communication channels, display equipment and power generators," Col Congdon stated.

The designer considering parallel design techniques, the speaker continued, must have a complete understanding of the trade-off between the failure rate of the part in question and the effect its added weight could have on overall performance of the system. On a missile, of course, weight was a far more important consideration than on ground equipment.

Expanding on Dr Ritchey's theme about the cost of achieving reliability, Dr Ruben F. Mettler, executive vice-president of Space Technology Laboratories, Inc, declared: "If the reliability objective and the reliability actually achieved by the system are too low, excessive costs for maintenance and replacement will be encountered when the system goes into service. Conversely, if the reliability goal is made too high and the necessary development test programme is laid out to meet that goal, then the development costs and the development time can become excessive."

Putting this in practical terms, Dr Mettler posed this situation: "Suppose an enemy plans to knock out a thousand American targets in a surprise blow. Recognizing that he has only, let us say, a two-out-of-three reliability expectancy, he can simply increase the number of missiles in the attack from 1,000 up to 1,500 and still accomplish his purpose. What is more, it may be a lot more sensible for that enemy design team to choose two-thirds as the proper reliability to work towards, rather than, let us say, to take several additional years and perhaps ten times as much money to try to strike 1,000 targets using, say, only 1,100 missiles of improved reliability of around 90 per cent."

Dr B. P. Blasingame, director of engineering at AC Spark Plug, the Electronics Division of General Motors at Milwaukee, Wisconsin, stated that today's guidance systems for missiles contained from 20,000 to 30,000 electronic and electro-mechanical parts, ten times more than early missile guidance systems. As a result, reliability requirements had been set ten times as high, and no ordinary design and test processes were good enough to ensure such reliability.

He said that two programmes introduced by the US Air Force as part of its ballistic missile effort and used in industry were helping to assure reliability in the face of growing complexity. One was a Parts Qualification Program under which sample quantities of parts were subjected to an environment much in excess of that which they would experience in the missile itself. Transistors, synchro-motors and even tantalum capacitors were put through the programme which, over a period of time, had resulted in the qualification of a large number of parts that might be used in new missiles with reasonable safety. Furthermore, he said, individual systems manufacturers were now interchanging parts test data through the Interservice Data Exchange Program, or IDEP, set up by the Army, Navy and Air Force for exchanging test data on ballistic missiles and space systems.

**TABLE II: XM-55 COMPONENT TESTS**

| Component Tests | No of Tests |
|---|---|
| (1) Combustion chamber tests: | |
| (A) Subscale | 32 |
| (B) Burst | 2 |
| (C) Hydro | 144* |
| (2) Propellant tests: | |
| (A) Subscale ballistic, less than 10lb | 26,060 |
| (B) Subscale ballistic, greater than 10lb | 696 |
| (C) Physical properties | 25,500 |
| (D) Environmental | 5,500 |
| (3) Nozzle tests | 196 |
| (4) Soft insulation tests | 700 |
| (5) Hard insulation tests | 560 |
| (6) Igniter tests, Pyrogen: | |
| (A) Bench tests with initiator | 50 |
| (B) Case impact | 3 |
| (C) Case hydro | 3 |
| (7) Igniter safe and arm tests: | |
| (A) Squib | 2,000 |
| (B) Pyrotechnic train | 50 |
| (C) Housing hydro | 3 |
| (D) Environmental | 6 |
| (E) Subscale ignition | 10 |
| (8) Destruct system tests: | |
| (A) Destructor | 50 |
| (B) Subscale destruct | 21 |
| (C) Environmental | 18 |
| (9) Destruct safe and arm tests: | |
| (A) Detonator | 2,000 |
| (B) Pyrotechnic train | 50 |
| (C) Environmental | 6 |
| (D) Subscale destruct | 85 |

* Non-destructive test; all others destructive.

"Because of IDEP and other records of prior usage of parts," declared Dr Blasingame, "we have had to test only 20 per cent of the parts on the Titan guidance system. Even so, parts qualification work accounts for about five per cent of the development cost of this system."

The second programme consists of formalized design reviews. Heretofore, an individual engineer's design was discussed with his supervisor and reviewed informally by an experienced designer. This now had been supplemented by a much more rigid and formal review process. Today each designer was required to compute the stress levels of all parts involved in his design, and then pass this information on to an applications review team which must approve the design. The result was that many design shortcomings were caught before they appeared in hardware form.

Designers at AC Spark Plug were provided with a series of manuals to assist them in their work, Dr Blasingame said. These included a parts selection manual kept up to date by the parts qualification programme, a parts de-rating manual, and a manual of design standards. Compiled from prior experience, the manuals were essential to "designing in" required reliability. "Designers begin to think quantitatively about reliability after they have been working to the severe environmental specifications called for in missiles," Dr Blasingame concluded.

## PENDINE TEST TRACK

Pendine Sands, on the shore of Carmarthen Bay, is one of the smoothest and flattest areas in the United Kingdom. In the 1920s they were the venue for successful attempts on the world land speed record, and today much higher speeds are reached there by rocket-propelled vehicles on the longest test track in Britain. The War Office recently marked the 21st anniversary of the move to Pendine of the Proof and Experimental Establishment by opening the gates to visitors, and although the British scale of operations may appear very modest in comparison with Aberdeen proving ground, Eglin AFB or China Lake, very full use is made of the facilities available. The Long Test Track has a length of 3,000ft, and varying numbers of 5in rockets are used to propel vehicles along the welded double rail at from 800 to 3,000ft/sec. Sleds on this track have been used for the dynamic testing of the warheads of all British Government-sponsored guided weapons, and static firing of warheads takes place along the seven miles of sand dunes.

# NATO AIR ORGANIZATION

## AAFCE's Problems and Potentialities

BY HUMPHREY WYNN

*Nike/Hercules installation—part of NATO air defence—manned by a Belgian Air Force unit*

AT the entrance to the Camp Guynemer headquarters of Allied Air Forces Central Europe, near Fontainebleau, stand seven flagpoles. Six are in a circle and bear the flags of the United Kingdom, United States, Belgium, Holland, Germany and Canada. In the centre of the circle flies the French flag, in deference to the country on whose territory the headquarters are situated; but there is a certain gentle irony in this, because of all the participating nations France is at present the least NATO-inclined. She has refused to have USAF nuclear-armed aircraft on her soil; she insists on being responsible for most of her own air defence. Yet it is on these very factors that the success of AAFCE as an organization depends: co-ordinated air defence for Central Europe, maintenance of a nuclear deterrent. In this context, it is significant that only recently, in a USAF re-organization, command of nuclear-armed fighter units based in the United Kingdom was transferred from the Third Air Force in the UK to the Seventeenth Air Force, whose headquarters are at Ramstein, Germany.

Yet French personnel are still serving at AAFCE headquarters and France has not withdrawn her hospitality from NATO formations at Fontainebleau and Versailles, names redolent with past imperial glories; and it is differing national points of view that AAFCE aims to reconcile in its day-to-day activities, its organization and forward planning.

Recently Air Chief Marshal the Earl of Bandon took over command from Air Chief Marshal Sir Harry Broadhurst, when the latter left the RAF for a post in industry; and it was to seek Lord Bandon's views on AAFCE, its present problems and its future role, that the writer recently visited Fontainebleau.

Nobody who meets "Paddy" Bandon (as he is affectionately known in the RAF) can fail to be exhilarated by the experience: a quick talker, he takes continuous nervous puffs at a cigarette; when he laughs, it is a hearty guffaw which partakes of his whole personality and blows away any possible idea of pomposity. You need to reassure yourself of authority by looking at the broad rank stripe and three narrow stripes on Lord Bandon's arm: but the laughter is a healthy antidote to any ponderousness in discussing strategic questions.

On the wall behind Lord Bandon's head is a world map, a reminder to the visitor of NATO's global perspective and a fitting background to the Commander's previous appointment, as C-in-C Far East Air Force. This brought him into contact with NATO's Pacific equivalent, SEATO, the South-East Asia Treaty Organization; so on the score of working with other nationalities he brings plenty of experience to his present post, and can also see European problems in the context of facing the other great Communist power, China. Further, Lord Bandon knows the West German situation at first hand, having commanded RAF Germany and the 2nd Allied Tactical Air Force before going to the Far East in 1957. He has close personal friendships with Air Marshal John Grandy, his successor at 2nd ATAF; with Gen Frederic H. Smith who commands 4th ATAF; and with Gen Sir James Cassels, C-in-C Northern Army Group and British Army of the Rhine.

### Widespread Command

As commander of the largest of the three NATO air organizations —the others have headquarters at Oslo (Allied Air Forces Northern Europe) and Naples (Allied Air Forces Southern Europe)—Lord Bandon heads a command of widespread area, with problems of size complicated by the politically sensitive location of headquarters and the largely theoretical approach to war problems. But he believes that if put to the test, the organization would work; on return from the Far East, he finds it stronger than it was when he left Germany, though problems still exist.

This strengthening is due in the main to three factors: addition of missiles to the West European defensive armour; co-ordination of air defence, so that both surface-to-air missiles and manned aircraft are under a unified control; and an increased West German contribution to the NATO armed forces.

Since Lord Bandon has been away from Europe the installation of Nike/Ajax (Nike/Hercules) sites has been steadily proceeding, so that the intercepter forces are now being backed by missiles. This might be a dubious advantage were control of the missiles in hands other than those controlling the fighter aircraft; but the Nike battalions are under 2nd ATAF/4th ATAF control; and most of the Central European area is under a unified air defence. The area excluded is most of France, which insists on sovereign rights in this sphere; and herein lies one of Lord Bandon's problems, calling for the exercise of diplomatic powers. But he is optimistic that, in a few years, the French may be putting their DAT (Defense Aerienne du Territoire) under SACEur as RAF Fighter Command has recently been. At least, while General de Gaulle remains in power, any AAFCE commander knows that he will have a stable government with which to deal.

### Questions of Finance

As far as Germany is concerned, the problems are of a different calibre. Again, so long as Dr Adenauer remains in power, the likelihood of any change in attitude towards the Western alliance is small; but the future is problematical. West Germany has rapidly grown in strength; her air force is equipping with Lockheed F-104 Starfighters and with surface-to-air missiles. Upon her co-operation, from so centralised a location, depends the effectiveness of Western defence.

With the smaller nations in AAFCE, the Netherlands and Belgium, there are fewer big problems; but there are questions of finance and representation, the latter being worked out on the basis of national contribution. Money is always easier to come by for national rather than international causes: as Lord Bandon puts it, it isn't so much the amount of money that goes out, but to whom it goes. Contributions to AAFCE, especially from less wealthy countries, have to be handled carefully. Similarly a good deal of tact and judgement is required in making appointments to headquarters: these are all approved (or disapproved) by the Commander, and often the balance has to be weighed between political and military considerations. The important thing is not to offend any national susceptibilities.

Lord Bandon's biggest overall problem is one which can only be answered if hostilities should occur: whether a conflict could be localized; and how use of the deterrent could be graded. He believes that there is much less chance of localizing a conflict in Europe than there is in, say, a Far Eastern theatre. In Europe, it would be a case not of deciding whether to use the deterrent, but what form of deterrent to use. This may seem a dreadful prospect; but from the Commander's point of view it is the only realistic one.

Working-out the details of policies is not part of the Commander's duty. He has a staff on which all seven national air forces are represented, its responsibilities divided according to the main facets of AAFCE policy: air defence, operations, logistics—each with their sub-divisions into related departments. At the head of this staff (the total is about 1,000, some 300 officers and 700 o.r.s.) is the Chief of Staff, Air Marshal D. G. Morris. It is perhaps significant that Air Marshal Morris, as Assistant Chief of the Air Staff (Air Defence) from September 1957 until February 1959, was one of the three officers appointed by the RAF to implement the new defence policy under which missiles were introduced into the armament of Fighter Command. Before that appointment he had been Senior Air Staff Officer at 2nd Allied Tactical Air Force,

(*Concluded at foot of page 863*)

*Aggressive nose, tall fin and egg-like undercarriage fairings characterize the Super Broussard, here seen flying at the Paris Show with the starboard engine feathered*

"Flight" photograph

BY MARK LAMBERT

**No 148 of the series**

# HOLSTE SUPER BROUSSARD in the Air

DURING the Paris Salon I had a meeting with Max Holste, a man I greatly admire. Having flown the Broussard in 1956 and the piston-engined Super Broussard prototype in 1959 (*Flight*, November 13, 1959) I asked him whether I might try the latest version with 1,000 h.p. Turboméca Bastan turboprops. He immediately agreed, and the trip was duly laid on with Nord, who now manage the project. Thus I found myself, one Paris afternoon, in the spacious flight deck with test pilot Jouannet and a couple of flight engineers. No passengers were being carried, because it was understood that we were going to wring the aircraft out a bit; and a fine, hard-working trip it turned out to be.

In 1959 I was delighted with the Super Broussard. It handled like a great big Chipmunk, smoothly and precisely, with excellent manœuvrability all the way down to the stall and a simplicity of handling which made really wild, steep approaches a quite normal procedure. I remember, too, that the undercarriage suspension was like that of a Rolls-Royce.

The new Super Broussard is, of course, larger and much more potent and cruises a good deal faster. But it still retains the great big flight deck, superb undercarriage and excellent low-speed handling. In addition it has some new features which particularly impressed me. Handling during simulated engine failure, for example, is almost unbelievably docile.

The flight deck is unusually spacious and can be reached through a separate car-type door to starboard. Controls and instruments are laid out for single-pilot operation, with power, trim and radio controls along a broad central console. Only the three basic flight-instruments are repeated for a co-pilot and they are located at the top of the engine-instrument panel. Dual controls are fitted, but toe-brakes, used also for steering, are only on the left. Some electrical switches are on a small panel in the roof. Immediately behind the flight deck, between the propeller discs, are galley and radio racks; and a spacious toilet is at the back of the 23-seat cabin. Ailerons are slotted, with Frise-type projections; the flaps move back and down and are double-slotted; and the elevator is completely straightforward, without down-load springs.

Each Bastan is controlled in flight from two levers, one of which sets the r.p.m. and the other the fuel input. One hundred per cent is 33,000 r.p.m., but normal take-off and climb speed is 101.5 per cent, 33,500 r.p.m. The levers provide limited freedom to adjust r.p.m. down to 96 per cent, and power is controlled in the normal way with the fuel lever. Indication of power is by P1-P2 gauges (ratio of compressor inlet to compressor outlet pressures). In addition there are four pitch-stops—feather, flight coarse, flight fine and ground fine, the last-named known as *pas nul* but actually being −2°. The fuel cut-off operates at the closed position of the fuel-input lever (which I will from now on call the throttle), and feathering is either by pressing a conventional button or by lever. An additional system is automatic feathering, which operates only at full power. If thrust is lost, the fact is sensed by loss of pressure differential between pitot heads mounted at the wing-tip and behind each propeller disc, and feathering follows automatically in a few seconds. For test and demonstration purposes, Holste had provided a cut-out for automatic feathering at lower powers as well.

The engines were started in *pas nul* by pressing a button and, after a few seconds, moving the pitch lever forward until 90 per cent r.p.m. were reached. The engine was then in its power range and pitch automatically coarsened to give thrust. High r.p.m. were therefore essential for power, and engine noise was accordingly considerable in all normal operating conditions. Some improvement in cockpit and cabin noise-level is expected when soundproofing is completed. At first I found the engine-control system a little difficult to understand, but in flight it was completely simple, involving only the movement of the single pair of throttles. Finally, I noted that the a.s.i. was marked in American style, with a white stripe from 65kt to 125kt, an overlapping green stripe from 80kt to 209kt and yellow from 209kt to 243kt. Maximum speed for flaps was 112kt and for undercarriage extension 125kt.

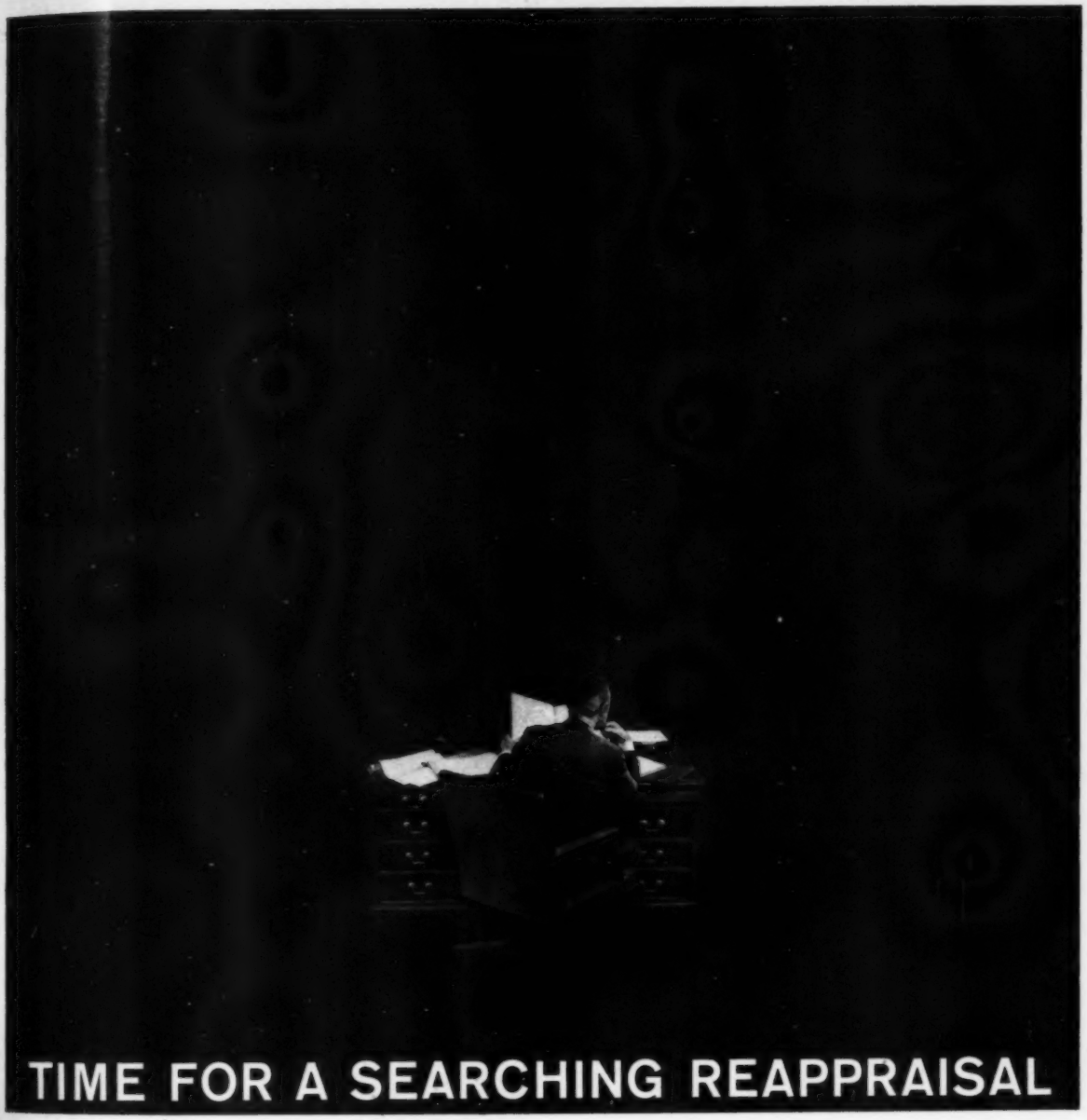
Jouannet taxied out, using the brakes and asymmetric power where necessary, and then lined up on the runway, ran up to full power, checked the pitch-stop switches and closed the throttles to observe their correct operation. With the aircraft shuddering and raring to fly he then let go the brakes and held straight for about 20yd before handing over control to me. Rudder was already effective and, as we accelerated very rapidly, I began to pull the stick back, finally flying off at 80kt and settling straight into a steep climb at 115kt. Gear retraction was imperceptible but there was a small nose-down lurch as the 5° of take-off flap came in. Flight coarse-pitch stops were then switched on.

As quickly as possible we cleared the crowded Le Bourget circuit and settled down to fly away to the east. Cruising power soon built up 180kt i.a.s. at about 3,000ft and I began to feel the aircraft out. It flew absolutely true, holding itself firmly, and was easy to trim precisely. Co-ordinated turns could be made equally well with rudder or aileron alone, but control forces were high, with a high force-gradient, and the achievable rate of roll was low. The trimmers were delightful: absolutely precise, easy to move and without the slightest backlash. The trim-wheels were also of just the right size and shape.

I was a little disappointed to find this machine rather heavy and not

"Flight" photograph

*There is a great deal of room in the cockpit and controls are laid out for one-pilot operation. A bank of ganged propeller pitch-stop switches is above the blind-flying panel; radio controllers, throttles, pitch levers and trim-wheels are on the central console*



# TIME FOR A SEARCHING REAPPRAISAL

**In the light of current developments in air cargo, we challenge you to consider this statement.** The time has come to make a searching reappraisal of air freight operations if they are being conducted with obsolete piston-powered passenger aircraft that have been converted for cargo. We are convinced that these aircraft, although they may still represent a multi-million dollar book investment, should now be disposed of, notwithstanding current market prices, and replaced by the modern all-cargo Canadair Forty Four. Inevitably, the disposal will result in a "profitable loss," because it can be shown that the Forty Four is the only all-cargo aircraft able to operate at a profit, either domestically or internationally, under the new low freight rates and will recover in a short period of time the losses incurred on the sale of the outmoded converted equipment. Any General Dynamics or Canadair official would welcome the opportunity to discuss this in more detail.

CANADAIR LIMITED, MONTREAL—A SUBSIDIARY OF GENERAL DYNAMICS

Please address enquiries to European Representative: John Winterburgh, Canadair Services Limited, Princes House, 190 Piccadilly, London W.1., England.

44.3in CUK-61-1

**Alvis Leonides engines power the Westland, Whirlwind Widgeon and Sycamore Helicopters.**

ALVIS

**LEONIDES AERO ENGINES**

ALVIS LIMITED COVENTRY · ENGLAND

# HOLSTE SUPER BROUSSARD

## in the Air . . .

*Waking for take-off. Walking in a group from the tail are John Thirkettle, Nord's Super Broussard foreign sales executive, M. Jouannet, Holste test pilot, and a representative of Wien Alaska Airlines. In the foreground is Mr Wien of Wien Alaska*

"Flight" photograph

to be able to recognize the old piston-engined prototype at this speed, but flying "in the groove," when combined with very good stability, can make for comfortable cruising. It is very much a matter of opinion. I rediscovered the old prototype's charm when I reduced power and slowed down to 115kt. It all came back like an old favourite tune: that splendid manœuvrability with a very high rate of roll, well co-ordinated and light controls and a silky smooth feel. Here once again was the Super Broussard you could really throw about. I could still just about make a co-ordinated turn on rudder alone, or with aileron and just a touch of rudder for a fast roll. The controls were free of friction, they centred nicely and the aircraft straightened up well when the controls were released in a sideslip.

I began to get the feel of the windows and felt that the wide, shallow windscreen, which is a long way ahead of the eyes, could be a little deeper and the blind spot above could be removed. Jouannet later told me that the windscreen will in fact be pulled back and made of two long raked panels instead of a row of windows. The pillars will also be rather narrower and the roof windows will be repositioned. Downwards visibility to the side was uninterrupted, the engines being well behind and way above the cockpit.

A clean stall was next indicated. I closed the throttles; the r.p.m. remained virtually constant, speed fell off slowly and the nose rose steadily as the angle of attack increased in level flight. The warning light was flashing in the undercarriage handle and the stall-warning horn began to blare at 80kt. I still had good aileron control, but at 70kt a gentle buffet appeared and application of aileron caused incipient stalling of one wing or the other. Then the Super Broussard broke slowly and sedately as I pulled the stick fully back. The nose went down and, as I continued to hold the stick back, the aircraft rolled very slowly to the left. I let go, used a little aileron but no power, and recovered from the dive without any difficulty. There was good warning, and the stall was slow and graceful.

I next opened up, gained 120kt, trimmed, and lowered the undercarriage with my hands off the stick. Some time after the wheels were locked down the nose began very slowly to drop, but that was all. So I just nudged the trim-wheel and started lowering flaps by degrees at 100kt. Take-off setting of 5°, applied with the stick free, caused no change at all; 10° a trace of nose-up change; approach setting virtually nothing; and the full 35° a gentle nose-down change. With power off, we then descended at 80kt and 1,200ft/min—a very good gradient for an aircraft of this size. I threw the machine about a bit, finding that I needed a good deal of rudder to co-ordinate the turns, but there was still a high rate roll at 75kt and plenty of manœuvrability to spare. To check the overshoot, I then applied full power with the stick free and the nose went very slowly down. In such circumstances one expects a nose to go firmly upwards.

Raising the undercarriage in a climb at low speed but full power brought no trim-change. The first half of retracted flap caused a firm nose-up change and the last half exactly the opposite nose-down change. The trim alterations were rather stronger because of propeller slipstream. Altogether, this behaviour under changes of configuration and power was of the kind that leaves a pilot complete peace of mind to attend to radio or look out of the window while preparing to land. It is rare to find a large aircraft with short-field (and grass-field) potentialities which exhibits such mild trim-changes. There is a difference of more than 100kt between the Super Broussard's cruising and approach speeds, and the overall speed range is of the order of 3:1. In the circumstances Holste were right to favour the low end of the range so far as controls are concerned.

It was now time for some single-engined flying and I prepared for some hefty swings as 1,000 h.p. was cut on one side or the other. But I was in for a remarkable demonstration. We settled at 120kt in level flight with moderate power and Jouannet said he would cut one engine suddenly. Out of the corner of my eye I saw him pull back a lever, but there was no swing at all. I simply could not tell which engine he had cut as I counteracted the merest twitch first this way and then that. Finally the Super Broussard settled into a very slow right bank and I realized that it must be the right engine. Sure enough, there was the stopped propeller outside the window. Jouannet just grinned. He then applied maximum continuous power on the left engine and the v.s.i. went up to 300m/min climb (970ft/min). I trimmed out easily and flew on, steadily reducing speed. Full rudder-trim was reached at 78kt, but there was still rudder travel and effectiveness left.

Jouannet said that the cutting of the engine was difficult to detect because propeller pitch immediately coarsened towards feather as the power fell off (we had used the automatic feathering facility). Engine inertia and coarsening propeller give a momentary surge of power which completely masks initial failure, and the asymmetric condition therefore develops slowly enough to be barely perceptible. I have never met anything like this before.

My final experiment, and one which I always regard as something of a 64-dollar question, was to fail an engine in a condition corresponding to initial climb after take-off and to see whether I could achieve a stable climb without losing height. We therefore set full power on both engines with gear up and 5° take-off flap extended at 90kt, which was 7kt above VMCA. Best single-engined climbing speed was 100kt. I settled into the climb at about 800m (2,600ft) and asked Jouannet to cut one engine at 1,000m (3,280ft). As we passed the mark there was again that indeterminate hesitation which told me that one or other engine had stopped. I corrected uncertainly, raised flap, the speed went straight up to 100kt, and before I realized that it was all over we settled in a climb without losing any height at all. It was astonishingly easy.

---

**HOLSTE MH.260 SUPER BROUSSARD**
**(Two Turbomeca Bastan IV giving 987 e.h.p. each)**

Span, 71ft 11in; length, 59ft 2in; wing area, 592 sq ft; empty weight, 11,477lb; gross weight, 21,605lb; wing loading, 36.5lb/sq ft; fuel capacity, 459 Imp gal.
**Performance:** Maximum cruising speed at 9,840ft, 242 m.p.h.; maximum range, 940 miles; rate of climb, 1,930ft/min; service ceiling, 32,000ft; take-off distance to 35ft for 495 mile stage with 23 passengers, 1,798ft; ditto with engine failure at critical point, 2,820ft; landing distance over 35ft at 17,415lb, 1,772ft.

---

I believe that a propeller windmilling against its flight coarse-pitch stop after engine failure at less than full power (without automatic feathering) might cause a good deal of drag, but the critical take-off and initial climb case is more than covered.

I was by now ready to go home again, and we set course for the traffic cauldron at Le Bourget. As we joined circuit very circumspectly there was a Noratlas steaming in below us on a reciprocal heading, and the tower complained that they had no radio contact with the Trener Master performing superb zero-altitude aerobatics just next to our touch-down point. In this tricky situation small trim-changes as gear and flaps extended were a blessing, for we were all busy peering through the windows—hawking it like a watch, as they say. Slowly we slid down in a curved approach, trying to judge whether the Trener would be at the bottom or the top of his next loop as we touched down.

I had picked an approach speed of 80kt, but the Super Broussard did not hold its approach speed very exactly and we slid back to 75kt without any warning trim-change. But this and lower speeds are perfectly acceptable and Jouannet looked quite happy. The Trener made a dart past the window, but was at the top of a loop as I rounded out gingerly with controls now a trifle sluggish. I felt that we were much too high, and the speed was down below 70kt, so I eased the nose down and immediately the main wheels kissed the runway and Jouannet started braking as the propellers went into *pas nul*. Not a graceful arrival, perhaps, but a superb demonstration of that remarkable undercarriage suspension. The Trener just went on buzzing round us like a bluebottle.

At the moment, longitudinal stability is weak at the very lowest speeds and the Super Broussard does not indicate changes in speed clearly, but both matters can be remedied. Apart from this, I was delighted with a busy 70min flight.

# PIPER CHEROKEE in the Air

### No 149 of the series

AFTER producing many thousands of Tri-Pacers and Caribbeans, Piper have finally introduced their replacement, in the form of the Cherokee; and the new aircraft is an improvement on the old in every respect except cruising speed. Although completely new, from its all-metal structure and Comanche-type cabin to its thick, laminar-flow wing and slab tailplane, the Cherokee retains the fixed-nosewheel undercarriage and Lycoming 160 h.p. engine which were features of the Tri-Pacer. But here the generic resemblance with the Tri-Pacer ends, because the Cherokee is much more like a young Comanche than like a revamped Tri-Pacer—and it feels a little bit like a Comanche to fly.

The actual Cherokee which has been demonstrated here is the eighth pre-production aircraft, rushed to Europe for the Paris show and assembled by Vigors Aviation Ltd at Oxford with only hand-written instructions. Very little was in fact known about it beyond what was contained in the brief flight manual giving limitations and a weight schedule. Nevertheless, anyone who has flown a Comanche would feel quite at home in the Cherokee. The central brake lever and steerable nosewheel are unchanged, as are the entrance door and walkway over the wing. The seats and ventilators adjust in the same way and the engine instruments are virtually identical, but visibility through the very deep windscreen is now much better. I spent some seconds finding the starter button when a final tweak of the keyed ignition switch did not start the engine, but that was the only surprise.

An intriguing feature is that the Cherokee contains about half as many parts as the Comanche, and I noticed while flying it that the top of each wing is skinned with only three sheets of metal, all flush riveted to wide-spaced ribs. The wing itself is fat and the spar set well back to leave a large area of cabin floor unobstructed. Seating space seems a little tighter than in the Comanche, but the luggage locker, in which 100lb may be stowed, is exactly the same size. There are also four ventilators, a central fresh-air vent, and separate cabin heater and windscreen defroster. These and anti-corrosion treatment over all internal structure are standard features. The basic Cherokee carries only essential flight instruments, but the demonstrator accommodated a Piper Autonav radio compass and Narco Super Homer with a little panel-space to spare.

Gross weight, at 2,200lb, is 200lb higher than that of the Tri-Pacer, and fuel capacity, at 42 Imp gal, is also considerably increased. With full tanks and with radio, but without baggage, the aircraft can carry four 12-stone people. Cruising speed at 75 per cent power with a fixed-pitch propeller is quoted as—and proved to be—an indicated 115 m.p.h. In addition to improvement in accommodation the Cherokee offers altogether better handling qualities, even in this hurriedly assembled demonstrator in which many of the finer points were masked by a small degree of control friction.

Limitations are: VNE, 171 m.p.h.; maximum structural cruising speed, 140 m.p.h.; maximum manœuvring speed, 129 m.p.h.; maximum flap speed, 115 m.p.h.; maximum loading, 3.8g. No negative g manœuvres are allowed. This is one of the first American light aircraft with a manœuvring speed above cruising speed.

When I tried the Cherokee at Kidlington one recent windy day I first sat in with the Marquess of Kildare while he practised some landings in preparation for a demonstration on the following day. Then he left me to it and I looked round to see where things were. The fuel selector, on the port-side wall, I left on right tank. I turned on the master switch, fuel booster pump and the two rotating beacons at nose and tail, and, as already remarked, twisted the magneto key to the position at which I thought the engine ought to start.! When it did not I hunted round and found a starter button next to the master switch. With the Lycoming now running I tuned a congenial BBC programme on the Autonav receiver, set the ventilators to keep me cool, wound the trimmer in the roof to neutral, checked flap operation, exercised full control-wheel travel and released the parking catch to start moving. For a strange aircraft, this was about as simple a procedure as one could find. The aileron wheel turned 90° each way and, when pulled right back, rose up curiously under one's chin at the end of its travel. The rudder pedals were firmly connected to the nose-wheel and apparently remained so in flight as well.

Moving off on about 1,000 r.p.m., I pushed firmly on the rudder pedals and turned in each direction about the inboard wing-tip. Turning radius was sufficient for all normal purposes. The brakes, applied together only by the single central lever, were effective and smooth. Rolling over firm, short turf, the suspension was very good, but a hard stop on the nosewheel oleo operated when the brakes were applied, presumably to keep the propeller safely clear of the ground. Visibility was fully adequate.

Take-off brought no surprises, a slight pull to the left being comfortably held with slight right-pedal pressure. Speed built up slowly until I flew off at 55 m.p.h. and climbed at 70 m.p.h. to a height at which I could begin to learn the aeroplane. I knew virtually nothing about it except that it was supposed to cruise at about 115 m.p.h. on 2,400 r.p.m., which was 75 per cent power. The first impression of handling was very good, with positive response from the ailerons and a classic general feel. Longitudinal stability was firm, with short-period oscillations after a disturbance. Yes, the Cherokee felt good.

Levelling off in bumpy air, I had to trim into the cruising attitude and wait some time for speed to build up, but it did reach 115 m.p.h. after a while. The aircraft waffled directionally a good deal in rough air, rather like the Comanche, but seemed to be holding its overall course and attitude. Accurate turns could be made with aileron alone, but rudder alone caused some skidding and the nose dropped fairly quickly. I would say that the Cherokee had stronger lateral than directional stability and was slightly short on rudder, a combination which I had also found in the Comanche.

Noise-level at 75 per cent power was moderately high, and there was a strongish vibration which made the artificial horizon-bar tend to quiver. This might well have been a feature of a hurriedly assembled pre-production aircraft. Visibility through the very tall windscreen was much better than in the Comanche, but the side windows were not generous. I could easily lean forward and see upwards through the windscreen in a turn—a valuable safety feature. At 2,200 r.p.m. the noise-level was much lower, but at all times I could clearly hear a radio commentator discussing some women's topic over the cabin loudspeaker.

I tried a few climbs and noticed that full power at 75 m.p.h. gave a steady 1,200ft/min with a light load consisting of only myself, right tank two-thirds full and left tank just over half full.

Having sounded-out normal clean performance and behaviour, I throttled back to reduce speed, Slowly the a.s.i. needle travelled back over the dial and the angle of attack increased as I kept the Cherokee flying level. The distinct general buffeting was followed by a slow drop into a steep, left-hand spiral dive, from which I was able to recover immediately without using power. This was something of a surprise. The Cherokee appeared to have sufficient elevator to stall properly and go into the spiral, but it did it in the most gentlemanly way, without lurching or flicking at all; and there was clear warning in the preliminary buffet. The stalling speed was an indicated 55 m.p.h., but Vigors had not yet calibrated the a.s.i. and the actual speed could not be guaranteed.

I next trimmed the Cherokee, power off, at 100 m.p.h., released

*". . . the Cherokee is much more like a young Comanche than like a revamped Tri-Pacer—and it feels a little bit like a Comanche to fly"*

*". . . anyone who has flown a Comanche would feel quite at home in the Cherokee." This is the Cherokee's tidy cockpit layout, with flight instruments on the left, radio panel in the centre and engine instruments to the right*

the wheel and pulled the flaps progressively through their three positions. The first setting gave a slight nose-up trim, the second no change and the third a nose-down trim which cancelled out the first. I was able to apply full flap without touching the wheel, the only result being a gradual reduction in speed at a virtually constant attitude. I then wound the trimmer fully back and the speed stabilized at 67 m.p.h. Longitudinal stability was good. A good deal of rudder was needed to produce high rates of roll in co-ordinated turns, but quick turns were possible without incurring a stall. Still trimmed at 67 m.p.h., I applied full power and the Cherokee reared firmly into a steep climb and winged over to the left, indicating about 40 m.p.h. The trim change was firm and rate of pitch fairly fast, but a moderate effort was sufficient to hold the nose down. With full power at 40 m.p.h., the aircraft was still flying and no stall warning was yet apparent. At 55 m.p.h. the rudder had lost most of its effectiveness. I found that up elevator appeared to mask the rudder and that only low rates of roll could be achieved with the stick back. Trimmed at 70 m.p.h. at full power, I raised the flaps with the wheel free. Again the nose went first one way and then the other and settled where it had originally started. Lowering the flaps with some power on at 110 m.p.h. resulted in an overall slight nose-up trim change. Gliding at 70 m.p.h., I could achieve crisp, fast rates of roll, but needed ample rudder to cancel adverse yaw. Rudder was sufficient for only mild side-slips, but the aircraft centred again well when the controls were released, despite some control friction on both aileron and rudder.

Finally I tried accelerated stalls, pulling the stick hard back in both straight glides and steep turns. Here the behaviour was remarkably good. The nose came sharply up, the tailplane shuddered hard and the nose fell back to the horizon without any sign of flick in either direction. Particularly noticeable was the excellent effectiveness of the tailplane, even at the lowest speeds. It is rare to find an American aircraft of comparable performance which has a genuine stall without running out of elevator first.

Coming back to Kidlington, I made my first glide approach at 75 m.p.h. with a rate of descent little short of 1,000ft/min—a good gradient offering excellent view of the touch-down area. Rounding-out at 70 m.p.h., the Cherokee floated in a nose-down attitude for some distance before allowing itself to be put down with the nose-wheel just off the ground. The main gear gave exceptionally smooth shock-absorption, and directional control and braking were very good. I suspect that best braking would be achieved if the flaps were raised immediately after touch-down, *à la* Comanche. My next approach I made power-off at 65 m.p.h. The float was almost gone, but control was adequate despite gusty conditions. Stability during the approach was good. Finally I tried an approach at 60 m.p.h., slowing to 55 m.p.h. during the round-out and applying a trickle of power to blow the flaps a bit. I touched down without any float at all, put the nose down, applied brakes and rolled little more than 100yd. During successive take-offs, I noticed that flap helped only in lifting the Cherokee off the ground. I found the best technique was to start clean, pull the first degree of flap at 40 m.p.h., pull off, and immediately raise flap to get the best climb clean at 70 m.p.h.

Altogether, the Cherokee is an excellent aeroplane, related in many characteristics to the Comanche. It feels pleasant to fly and is more of a pilot's aeroplane than is the Tri-Pacer, though without having become in any way more difficult to fly. The kindergarten has been taken over by the Colt and Super Cub, and the Cherokee has rightly taken its place in the next grade with the Comanche. Trim changes are remarkably small in all cases except during application of full power in a glide approach. Manœuvrability at the lowest speeds is adequate for bumpy weather, except possibly when high elevator angles tend to mask the rudder. A full stall is achieved in unaccelerated flight, but it is slow and not vicious; and the accelerated stall is particularly good. The resultant tailplane effectiveness at low speeds is really useful in short landings and can give great confidence; the minimum approach speeds can be safely used without tumbling onto the ground with the stick hard back. The undercarriage is exceptionally good, particularly when ill-used. Cabin amenities generally are well up to Comanche standard. Anyone can be happy to be seen in a Cherokee. C. M. L.

**PIPER CHEROKEE**

**(One Lycoming O-320 giving 160 h.p.)**

Span, 30ft; length, 23ft 3in; wing area, 160 sq ft; fuel capacity, 42 Imp gal; empty weight, 1,195lb; gross weight, 2,200lb.

**Performance**: maximum speed, 138 m.p.h.; cruising speed, 115 m.p.h.; stalling speed, 50 m.p.h.; take-off run, 775ft; landing run, 550ft; rate of climb 680ft/min; endurance, 6hr.

## NATO AIR ORGANIZATION (continued from page 859)

Germany, so he is well acquainted both with the tactical situation of his present work and with the problems of hardware.

Air Marshal Morris is a South African. In photographs he appears severe, because of the deep lines on his face and square cut of his jaw; but this impression is belied in conversation: with mobile features and intensely blue eyes he gives an air of frankness and speaks with deliberate care in his choice of words. He is particularly anxious that NATO should be understood, and in his work at AAFCE has an opportunity of seeing its implications in local terms—especially, for example, in the siting of missile bases, Aircent having responsibility for Nike and Hawk installations.

Other responsibilities are the direct concern of the Chief of Staff, particularly training and supplies. Under the former heading come matters like finding air-firing facilities for intercepter aircraft, now that the Sylt range is being handed back to the Germans. As Air Marshal Morris remarks, "the aircraft that fires guns is on the way out"; missile targets are needed. This immediately brings in the question of finance. Whereas towed targets can be peppered comparatively cheaply, a drone aircraft which is destroyed if the missile shot is successful costs a lot of money.

Air Marshal Morris has no doubts about the reality of a nuclear threat from behind the Iron Curtain. "When the Russians got behind the United States in the development of nuclear weapons, they concentrated on spaceflight—with what results we now see; but no doubt they have developed small nuclear weapons." Like the Commander, he has a keen appreciation of the threat which faces the NATO forces. He does not advance any exaggerated claims for the success of AAFCE organization, but believes it provides a practical answer to possible eventualities.

The symbolism of international co-operation at Fontainebleau is interesting and encouraging. One wonders what Napoleon, brooding imperially in his nearby chateau, would have thought about it all. Perhaps he would have preferred the flowers to the flags. He would certainly have liked the French flag to remain at the centre.

*First g.a. drawing of the Model 1121 Jet Commander designed by Aero Commander Inc, the prototype of which is expected to fly within twelve months (see news-item on this page). Span is 43ft 4in, length 48 ft, and maximum design weight 14,000lb, and the aircraft will be powered by two General Electric CJ610 turbojets*

# Sport and Business

TWENTY THOUSAND PEOPLE were at Brakpan Airport, South Africa, on May 27 to see the finish of the last Governor-General's Cup Air Race. The first four places were taken by a Fairchild 24, Cessna 172B, Proctor 5 and Cessna 210 whose pilots won £700, £400, £200 and £100 respectively. The winning pilot was Mr A. P. Nieman, whose 20-year-old Fairchild must be one of the oldest aircraft ever to win this race. Mr Theo Delyannis was unlucky in coming third for the fourth time running in his 1947 Proctor 5.

Of the 39 aircraft entered, only two—a Tri-Pacer and a Tiger Moth—failed to finish. Both suffered engine trouble and force-landed safely. Other possible accidents were avoided by the decision a few weeks before the race to change the route slightly, avoiding the mountains on the Basutoland border. This shortened the race to about 1,100 miles and made navigation much simpler.

Of particular interest is the fact that the Durban Wings Club has decided to organize two similar races to be run concurrently—one for the faster aircraft and one for the others. This is not a substitute for the existing race but is accepted by many as an admission of its limitations. The big difficulty is the wind. Meteorology is far from a precise art in a big country like South Africa and a tail-wind may unexpectedly change to a head-wind when the race is half-way through and put the faster aircraft (the late starters) at a disadvantage. That is what happened this year.

As reported last week, the South African President, Mr S. A. Swart, is donating a cup to the Aero Club of South Africa to replace the Governor-General's Cup.

A FOURTH PILOT has joined the staff of McAlpine Aviation, Luton. He is Capt Hugh Watt, previously with Cunard Eagle Airways. Demonstration flying on two Helio Super Couriers (McAlpine are British agents for the type) and daily flights for McAlpine partners visiting construction sites are included in the current work of the McAlpine fleet, which now comprises two Super Couriers, a Piaggio P.166, a Cessna 310 and a DH Rapide.

*Members of Southport Aero Club with 'Aircoupe G-ARHC at Woodvale. Secretary/CFI David Vernon is in the right-hand seat, with chairman C. L. Jessop next to him on the wing. The new aircraft, operated at £5 per hour, has attracted many old and new members to the club, and is fully equipped for night and instrument flying*

WE REGRET TO RECORD the death on June 11 of Mr G. H. M. (Eustace) Miles, OBE, chairman of the Association of British Aero Clubs and Centres. After RAF service in the 1939-45 war at the Ministry of Aircraft Production, during which he attained the rank of group captain, Mr Miles formed the ABAC in 1946 and was responsible for building up the Association's organization and activities to the present high level of efficiency. He was appointed OBE in 1953 for his services to the club-flying movement, and had been ABAC chairman continuously since 1954. He was 58.

The establishment of standards for club operation and training was perhaps the first major achievement of the Association under Mr Miles' guidance. In recent years the scope of the ABAC has been widened to cater for small flying groups as well as for the larger clubs, schools and centres, and immediately prior to his death Mr Miles was working on plans for a further expansion to meet the needs of individual members and business aircraft operators. Other notable ABAC achievements which stemmed in large measure from the efforts of Mr Miles included the Air Training Corps flying scholarship scheme and the Firms' Flying Clubs scheme. Assistance in the formation of clubs and groups and in the legal formalities of various aspects of club operation; the supply of maps, navigational instruments and publications; and the compilation of a list of light aircraft aerodromes and landing grounds, were also among the services built up under Mr Miles' guidance. Mr Miles had represented the ABAC as one of the Association's two members on the Standing Joint Committee on Private and Club Flying and Gliding since the committee's formation in October 1958, and it was mainly through the medium of this committee that his more-recent efforts to strengthen the position of club flying in this country were made.

*Mr G. H. M. Miles*

Mr R. R. Paine of Derby Aviation, vice-chairman of the Association of British Aero Clubs, is acting chairman of the Association at present.

THE FORMATION of a British section of the US Experimental Aircraft Association has been proposed by Mr Arthur Ord-Hume, and a meeting to discuss this will be held at the Kronfeld Club, London, at 7.15 p.m. on Saturday, July 15.

PRODUCTION DELIVERIES of the twin-jet business aircraft recently announced by Aero Commander Inc, the Model 1121 Jet Commander, are expected to begin "in the third quarter of 1963." The prototype should fly within the next 12 months, and FAA certification should be obtained by the end of 1962. The price for the basic aircraft will be $475,000, or $555,000 completely equipped with dual navigation and communication systems, autopilot and radar.

Illustrated at the head of this page, the Jet Commander is designed to carry a crew of one or two plus up to six passengers. The normal passenger complement will be four. Estimated equipped empty weight is 6,800lb, and design maximum weight is 14,000lb. Design speeds include: 111 m.p.h. stall (clean); 95 m.p.h. stall (landing configuration); 415 m.p.h. cruise at up to 20,000ft; and M0.8 cruise at 20,000ft and above. The passenger and pilots' compartments will be pressurized to a differential operating pressure of 7.5lb/sq in, maintaining a cabin altitude of 8,000ft with the air-

*Jim Ryan of Gyrodyne hovering the XRON in typically relaxed mood at Paris. The little Gyrodyne (72 h.p. Porsche) is exceptionally docile and tractable and won a special prize in the French Aero Club helicopter competition. The company intend to teach someone without any previous airborne experience to fly the machine*

"Flight" photograph

*Improved ground-handling on Rollason Turbulent G-ARIZ is provided by the new tailwheel installation, which replaces the former skid, and by independent wheel brakes working from full depression of the rudder pedals*

craft operating in standard temperature at a height of 35,250ft.

Two typical flight schedules have been quoted by the company. The 1,025 n.m. flight from Los Angeles to Oklahoma City would take 2.81hr, for a total fuel expenditure of 4,448lb. This would be made up of five sections: (1) climb at max continuous r.p.m. to 35,000ft (0.23hr, 748lb fuel, 70 n.m.); (2) 435kt cruise at 90 per cent r.p.m. (1.76hr, 2,690lb, 766 n.m.); (3) 250kt descent to 5,000ft (0.57hr, 813lb, 189 n.m.); (4) hold at 5,000ft for 5 min at 200kt (140lb); (5) 10min to land at flight idle r.p.m. (157lb).

For the 1,036 n.m. flight from Oklahoma to Washington DC, the Model 1121 would take 2.73hr and consume 4,448lb of fuel. The schedule comprises (1) climb to 35,000ft (0.23hr, 748lb, 70 n.m.); (2) 435kt cruise (2.13hr, 3,307lb, 926 n.m.); (3) 250kt descent to 5,000ft (0.12hr, 70lb, 40 n.m.); (4) hold and land as previously (297lb).

THE RANGE OF AIRCRAFT available at the London School of Flying, Elstree, now includes the Fairey Tipsy Nipper at £2 15s per hour and (by arrangement with Oxford Aviation Co) the Piper Apache at £24 per hour.

MIDLAND GLIDING CLUB, which has its headquarters on the Long Mynd, Shropshire, has been carrying out aerotow tests with a recently acquired Auster from the ex-RAF Condover aerodrome, nine miles from Shrewsbury. The club is expected to use Condover as a second base, giving their members a better chance of getting gliding flights during busy seasons and cutting down the waiting time between flights. It was found that, with the Auster (an ex-Army AOP 6) 20 take-offs could be managed in three hours, compared with eight or nine with the winch on Long Mynd.

KINGFISHER FLYING GROUP is now operating Auster 4 G-ANHL from Panshanger, with the assistance of London Aero Club. The present flying rate is £4 10s per hour, and it is hoped to reduce this to £3 10s per hour soon. The group has a number of vacancies for PPL holders.

STRICTER CONTROL over agricultural-aircraft pilots has been ordered by the Australian Department of Civil Aviation. From August 1, pilots will be required to have a technical knowledge of spraying chemicals as well as a flying licence.

# AIRSPACE FREEDOM IN PRACTICE

**BY AUSTIN HARBINSON**

**THE author's letter on freedom of the air for private pilots which appeared on the Correspondence page of our April 6 issue has stimulated considerable interest. Mr Harbinson here follows it up with another account of a typical flight which he made recently from Niagara Falls. In his covering letter to the Editor, Mr Harbinson comments: "Freedom is a mighty big word that you can't fully appreciate until you hear the tower tell that American Airlines 72-passenger, four-engined turboprop Electra that he is number one to land—behind the Luscombe on final."**

I FIND that I have to make a trip to Hartford, Connecticut, from here in Niagara Falls. Immediately the question arises in my mind as to whether it is going to be better to drive by car or fly by private plane. On looking the situation over I find that, if I drive, it is going to be about nine hours each way and will cost about £7 10s for petrol, plus a super-highway charge of approximately £3, and bridge tolls, for the 800-odd-mile round trip. Then there is the wear and tear of tyres and grease and oil, which comes to another £3, then I will have to stay overnight at a cost of £3, which is about average for a night's motel stay here, plus two days' meals, another £4. This all adds up to £20 10s, not allowing anything for the unforeseen. If this all sounds expensive, don't forget that the average working man makes over £1 an hour here, and therefore a good meal will cost you anything from £1 up.

As there is a high-pressure system over the eastern United States I decide that it is much cheaper to fly, and this is how it goes. The aircraft is a Luscombe 8A of 1946 vintage, it has a 65 h.p. Continental engine and two wing tanks with a total capacity of 22gal. This gives me five hours' range with plenty of reserve. I have a portable VHF transmitter with an LF and broadcast band receiver, as the 65 has no electrical system.

It's 5.30 on the morning of March 31 when the alarm clock on top of the television goes off—on top of the TV so I won't reach out and turn it off in my sleep. I don't feel at all like getting up, but an early start is essential if I am going to get back tonight; so, out of bed and get breakfast. By 6 a.m. I am ready to go: but, not so fast, better check with the weather man first. A call to the local FAA weather bureau brings good news: clear throughout the East, becoming cloudy and overcast late this afternoon; there is a low-pressure system over Mississippi moving over Tennessee this afternoon, causing lowering ceilings to the south of my route late this afternoon; a cold front over the Great Lakes region is expected to reach Niagara Falls area tonight; the winds aloft are variable out of the north-west, surface winds will be generally out of the south-east later this afternoon. This picture looks excellent. I may even be able to catch a tailwind both ways if I play it right.

After the usual thorough pre-flight check I am ready to go. I get immediate clearance from the tower and I'm off at 6.45. I climb out to 5,500ft as visual flight rules require me to fly at odd thousands plus five hundred when going in an easterly direction if above 3,000ft. There are no fixed lanes that I must follow and I can fly the airways if I want to or go direct, whichever suits me best. In this case I will use both. Neither do I have to give notice in advance that I am going to use an airway, or that I am going to pass through it. I don't even have to give notice at all unless I feel like it, even though these airways are used by everyone from J3 Cubs to 707 jets, and a good many of the little fellows don't have radio at all. During my climb out I see a dense cloud-bank to the east and south of me at about 500ft with the tops at about 2,000ft.

I soon realize that this is lifting ground fog, as the temperature has been down to around 25° during the night. This is nothing to worry about as I can see that it is clear farther east, and that's where I'm heading. In a few minutes it's clear as crystal, not a cloud in the sky, and I can see 50 miles or more to the horizon—actually farther than 50 miles, but I can make out landmarks at 50. I see a Viscount passing about two miles to the south and below me; he is on the airway from Buffalo to Rochester and soon I will be crossing that airway—this is no time to have your head buried in a chart. By this time I have got my first ground-speed check and I'm getting 98—not bad considering that the Luscombe has a full-climb prop. My next check-point is the south-west leg of Rochester low-frequency range, and I'm getting a ground-speed of 101—I can't complain on this at all. I decide to fly the LF range into and out from Syracuse as it will be good practice. At Syracuse my ground-speed is down to 92. I pass just to the south of Hancock Field, where sleek-looking jet fighters are lined up very neatly, and a little later I see a Lockheed Electra decending just ahead of me. He passes directly ahead no more than half-a-mile away—close enough to see that he is American Airlines and almost at right angles to my path. (This is where I learned two good lessons in one fast session. I passed directly through his slipstream and for about two seconds all hell broke loose. Lesson number one, you should always treat with a great deal of respect the prop-wash of any large aircraft. Lesson number two, if I had been 30sec earlier and we had not seen each other this would surely have been fatal. Sometimes we are inclined to forget that we are not alone up here, and this serves as a sharp reminder. No doubt the champions of controlled airspace will say "I told you so. It's not safe to let private pilots use the air freely." I will have something to say to them later, but let's get on with the trip.)

I decide to use the LF range to check my position, and the next check-point is the intersection of the Syracuse and Utica ranges, a distance of 33 miles. I miss my estimated time of arrival by only 30sec, my ground-speed having gone up to 94, and soon I pass to the south of Utica City. Two hours have elapsed since take-off and it's now time to change tanks. I have been using the left tank and my policy is to use the left tank for two hours, then switch to the right tank and use all of the right tank. This way, when I switch to the left tank again, I know exactly how much flying time I have left. This procedure I follow all the time so that in case I ever get into

## SPORT AND BUSINESS...

an emergency I know just how far I can stretch my petrol supply.

Soon it is time to change course from 113 magnetic to 135, the reason for this being that if I fly in a straight line from Niagara Falls to Hartford I will pass over some mountains, in fact nearly all of my route would be over mountainous country. This is no problem other than that in case of emergency I would have very little chance of having a place to set down without damage to the plane and myself. So, for 20 miles extra, I stick to lower country where there are plenty of fields. It's not that I don't trust the engine, but this is like cheap insurance. I'm off the LF range legs now and must depend on the chart for navigation. Soon I recognize the town of Cobleskill and check the time—by now I am getting hungry.

My next check-point is Catskill of "Rip van Winkle" fame, 45 miles away on the Hudson river, and these are the Catskill Mountains I am flying over, where (the legend says) Rip van Winkle slept for so long. I had packed a lunch and a flask of coffee, and this is as good a time as any to have a cup of coffee and a couple of gravy rings—we call them "doughnuts" here—so I set the cup on the ledge just ahead of the seat and pour a cup of coffee. The air is so smooth this morning that there is hardly a ripple on the coffee and it tastes good, too. By this time I can see Catskill and the Rip van Winkle bridge across the Hudson river. I think to myself that I am cheating them out of 25 cents (bridge toll) for crossing the Hudson this time. My groundspeed has gone up to 104 this time, due to the fact that since I changed course a little while back the wind is now almost directly on my tail. There are three light aircraft in sight now far below and the chart shows that there is a small field nearby. The rest of the trip is uneventful, and I am getting stiff from sitting for over three hours in the same position, but soon I see Hartford and it's time to start letting down.

As I get closer I see three ships in the traffic pattern, two leaving to the south and one waiting to take off. There is no tower here and no control of any kind from the ground. I enter traffic on my downwind leg and follow a Cessna 170 in. He is faster and well ahead of me, so I hold the Luscombe off to the last minute so that I will not hold up traffic by taxying. There is a queue at the petrol pump—a Tri-Pacer filling up, a Cessna behind him and another Tri-Pacer behind that—so I decide to park and gas up later. The man in the office called a taxi and I was on my way. Flying time had been 3hr 45min. When I got back there was no queue—everyone gone to lunch, apparently—but the pumps were attended and I took 14.5 US gallons (11.6 Imperial) at a cost of £2 1s approximately.

### The Trip Back

I had expected to start the return trip at 2 p.m. and I was in fact ahead of schedule, getting off the ground at 1.45. There was very little traffic now, only a lone 170 shooting take-offs and landings. I had asked the gas boy how many aircraft there were on the field, and he said there were about 70 private ships based there and maybe a dozen business planes besides the trainers the operators owned.

Climbing out to 2,500ft I now use the 323° leg of the Hartford LF range to get an accurate heading set up, and after levelling off I get my first ground-speed check—not so good, 83. Hartford radio is giving the scheduled weather broadcast just as I leave, and it is raining in Washington. I have an idea that this low is a big one, but the weather along my route is good; just like the weather man said, there are lowering ceilings to the south of my route. My next check-point gives me a ground-speed of 86 and I can see that there is an airport a few miles ahead, so I am keeping an especially sharp eye. Sure enough, there it is up ahead, and there are two light aircraft taking off to the south-west, indicating that I have a cross-wind.

My next check-point is again on the Hudson river, a few miles to the north of Catskill, and my g.s. has gone up to 93. I get another weather report, from Albany this time, and it is still good (these weather broadcasts are made every half hour at 15min and 45min after the hour). An hour and a half out of Hartford, and by this time my g.s. is up to 98. That low-pressure system must be getting closer. The normal cruise for the Luscombe with this prop is about 95 m.p.h. (with a cruise prop about 105), and soon it is time to change tanks again, having used the left one for two hours. At 2hr 22min I am over Syracuse Range station again and there is a Mohawk Airlines DC-3 coming towards me on the same range leg, apparently, but there is plenty of separation and he passes well to my left. My g.s. is 102 now, I'm doing better all the time. In the space of 80 miles from Syracuse's Hancock Field to Rochester's Monroe County field I pass within five miles of *eleven* airports shown on the chart, only one of which is marked private. Furthermore, I am within 20 miles of 15 more. At Rochester I am 2min ahead of my ETA, giving me a g.s. of 109. The ceiling is 5,500ft overcast, according to Rochester radio, and at Buffalo it is 4,000ft overcast, so it looks like I won't be home any too soon. There is a Super Constellation taxying out at Rochester as I pass about two miles south of the field, and soon I meet a Capital Airlines Viscount off to my right making a long final approach to Rochester. There are two light aircraft in sight and Rochester radio is calling a Cessna. By this time I have had just about enough flying for one day, having been in the air 3¼hr since leaving Hartford; but, before I think it possible, I am approaching Niagara Falls, my ground-speed for this last leg being 128. I realize there is quite a breeze blowing, and when I get the word "Luscombe 31 Kilo cleared to land" I am ready to call it a day. I was able to turn off the runway at the first intersection, less than 300ft from the approach end, and I wasn't too tired to top off the tanks before tying down the ship. They took 13.9 US gallons (11.1 Imperial) at a cost of £2 1s—not bad for 3hr 40min.

I had covered approximately 760 miles for a cost of less than one-fifth of what it would have cost me to drive, so now you know why so many people use private aircraft for everyday transportation, not to mention the risk involved in driving and the time saved. Believe it or not, there were over 90 airports available to me within a distance of 20 miles on either side of my 380-mile route, about 20 of which had hard-surface runways and 40 had runway lights. The only airports I am not allowed to use are strictly military bases, and they are always available in case of emergency—but you had better have a good excuse.

### Fair Share

Now for the critics who will have something to say about my flying in the same airspace as commercial airliners. When I mentioned the champions of controlled airspace a little earlier I meant those unreasonable officials in the British Isles who want to eliminate the private pilot. Let me point out here that our airspace in the USA is controlled within reasonable limits; these limits are as follows:—

**Visual Flight Without Clearance**

*In Control Zones:* 2,000ft horizontally from clouds, 1,000ft above and 500ft below clouds; minimum ceiling 1,000ft; minimum visibility three miles.

*In Control Areas:* 2,000ft horizontally from clouds, 1,000ft above and 500ft below clouds; minimum ceiling, control areas do not extend below 700ft, therefore clear of clouds; minimum visibility, three miles, or under 700ft, one mile.

*Elsewhere:* Minimum 2,000ft horizontally from clouds, 1,000ft above and 500ft below clouds; below 700ft, clear of clouds; minimum visibility, one mile at all levels.

**Visual Flight With Clearance**

*In Control Zones:* Clear of clouds at all levels; minimum visibility not less than one mile.

*In Control Areas:* As without clearance. Note that above 700ft it is not possible to get a one-mile visibility minimum clearance as in a Control Zone. If visibility is less than three miles in a Control Area all flights must be in accordance with instrument flight rules.

*Elsewhere:* As without clearance.

Control Zones extend for a radius of five miles around most of the larger airports, and in some cases 12 miles with approach corridors extending for as much as 25 miles.

Control Areas extend for a width of ten miles along the airways and for a radius of as much as 50 miles around major airports. In addition to these there are climb-out corridors for military jets; these are restricted areas that usually extend 27 miles from the edge of the control zone and are graduated at seven intervals as to the altitude to avoid, starting at 2,500-10,000ft at 5-6 miles and ending up at 19,500-27,000ft at 20-27 miles. All airspace above 24,000ft is controlled, but that doesn't bother us little fellows too much. Incidentally, a call to the local Approach Control will usually give you clearance through a military climb-out corridor unless they have jets actually using it at that time.

I am sure that all pilots of light aircraft will agree with me that these are very reasonable restrictions, and any VFR pilot who gets caught in one-mile visibility is crazy. The big thing is that he is not going to get in a jam with the FAA if he does and, let's face it, anyone with enough savvy to get a licence in the first place thinks more of his neck than to go flying with one mile and 700ft. Every once in a while you hear of someone getting caught and proving the point conclusively. Generally speaking, the laws here were designed so that the good judgment of the pilot should prevail.

There is far less danger of having a collision by meeting another aircraft on an airway than in driving down the highway meeting other cars. I can remember when I was a little boy back in Ulster riding down the road with my father in his Austin Seven, 1932 vintage, and laughing at the old-timers who would climb up on the verge when they saw us coming. These people who want to run the private pilots off the airways remind me of these old-timers and, in a sense, they *are* the old-timers of this jet age, who just can't see ahead far enough to realize that private flying can be a boon to everyone.

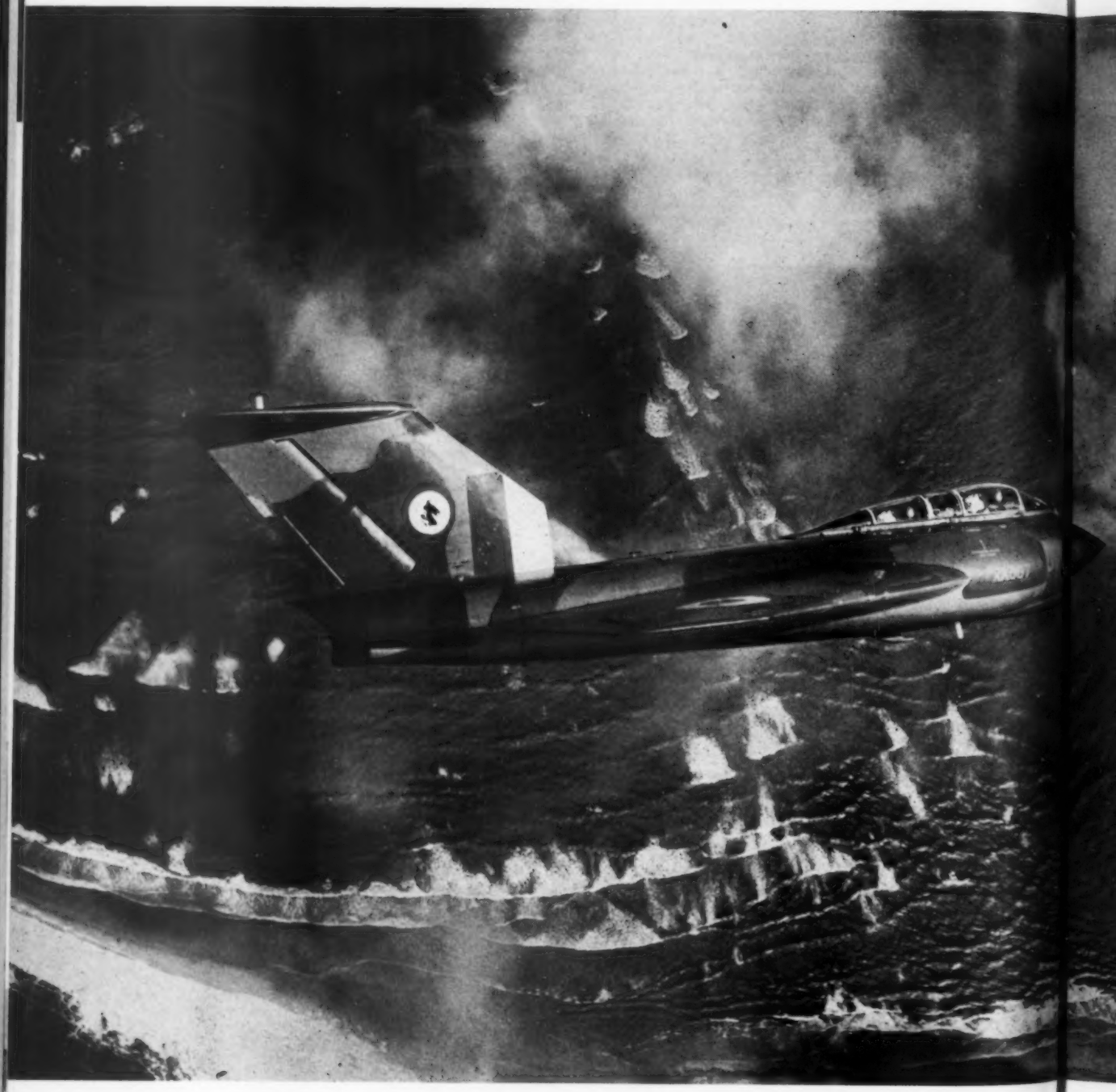
Sit up and take notice, British pilots. You, too, can have freedom of the skies.

# All-weather Men's Farewell

## LEEMING OCU CLOSING DOWN

AFTER FOURTEEN YEARS' RAF ALL-WEATHER TRAINING No 228 Operational Conversion Unit at RAF Leeming, on the Great North Road near Northallerton in Yorkshire, is closing down in mid-August. The air-to-air studies on this and the following three pages, taken recently by *Flight* photographer Ian Macdonald, pay tribute to the verve and ability with which the OCU instructors handle their Javelins. They also serve to emphasize the work which has been done at Leeming in training Fighter Command all-weather crews since May 1947. At that time, the aircraft used were Meteors; Gloster Javelins have been the unit's mounts since October 1957. Since then, over 30 courses have passed out, to supply Javelin squadrons. Last full course at Leeming is No 229, a number linking the OCU with its predecessor 54 OTU, whose No 1 course was at Church Fenton in 1940. The FAW.5 in these pictures was flown by Flt Lt Don Smith; pilot of the photographic T3 was Flt Lt Eric Ginger.

# ALL-WEATHER MEN'S FAREWELL . . .



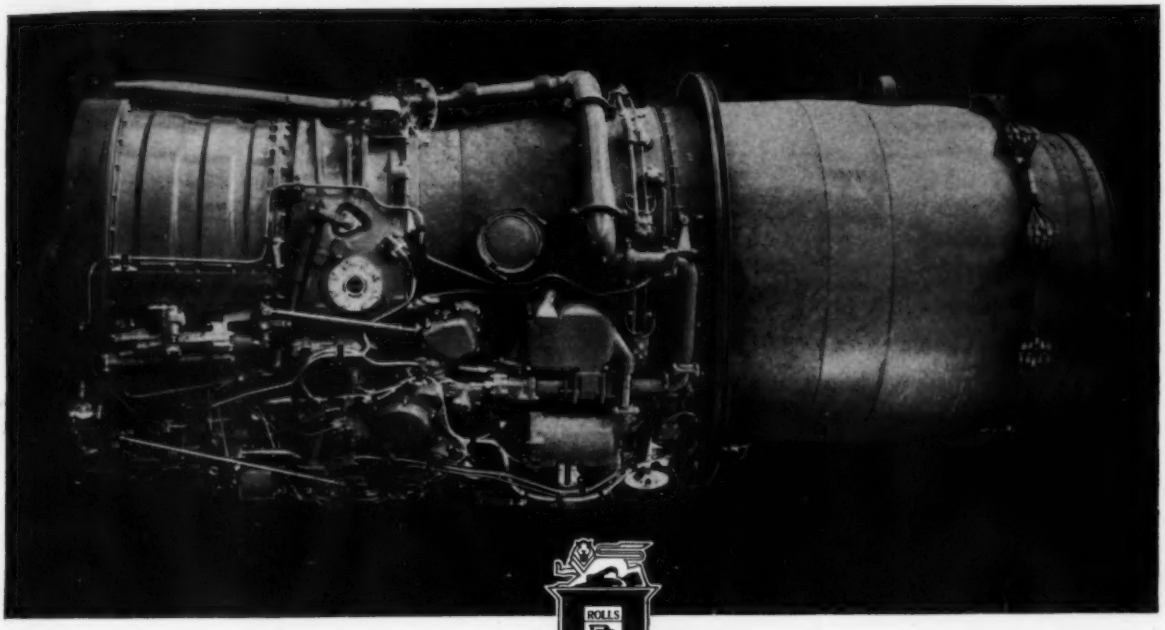
cloud and spray near Middlesbrough

Inverted thrust by Bristol Siddeley above the promontory

*Coastal inversion on a north-eastern summer's day*

*Eyes down looking—at the tide and seashore*

# ROLLS-ROYCE SPEY



# BY-PASS JET

**ROLLS-ROYCE SPEY ENGINES WILL POWER THE de HAVILLAND TRIDENT, THE BRITISH AIRCRAFT CORPORATION ONE-ELEVEN AND THE BLACKBURN BUCCANEER**

The By-Pass principle proved by the Conway is now accepted as the correct formula for jet transports

**ROLLS-ROYCE LIMITED · DERBY · ENGLAND**

**AERO ENGINES · MOTOR CARS · DIESEL AND PETROL ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION**

# One of the best jobs in the world

Fleet Air Arm Buccaneers moving at ten miles per minute above H.M.S. Ark Royal. The Buccaneer is the latest aircraft ordered for the Fleet Air Arm, giving still greater speed and power to Britain's nuclear age Royal Navy.

The men who fly these machines have a training second to none in the world, starting with a six months' course at the Britannia Royal Naval College, Dartmouth. The basic qualities required of to-day's officers of the Fleet Air Arm are the same as in Nelson's day – initiative, intelligence, resourcefulness and determination.

The responsibility is great and the rewards are equal to it – adventure, enjoyment, travel – and after 12 years a tax-free gratuity of £4,000 or £1,500 after 8 years.

Of course only a select number can qualify as pilots and observers. But why shouldn't *you* be among them? You must have a zest for flying, be attracted to the Naval way of life and be able to pass the Interview Board which is designed to test your fitness, intelligence and character.

The age limits for entry are 17–25. You must have passed the G.C.E. at "O" level in English Language, Mathematics and two other approved subjects (*three* other approved subjects after 1st September 1961).

When qualified, pay at age 20 is £949 a year; a married officer of 25 can receive up to £1,760 a year. Selected officers serving on a 12 year engagement have the opportunity of transferring to a pensionable career.

**5-year commissions for Helicopter Pilots**

There is a scheme of engagement for men wishing to specialise as helicopter pilots only. They join between ages 17–26 on a 5-year commission and receive £775 tax-free gratuity on termination.

Candidates who wear spectacles may in certain cases be considered for Helicopter Pilots.

*Send for the new illustrated booklet "Fly with the Fleet Air Arm" which will give you full details.*

# Fly as an officer in the ROYAL NAVY

**The Admiralty, D.N.R. (Officers), Dept. FR/28, Queen Anne's Mansions, London, S.W.1.**

FAA 16

Travel Air into Fokker D.VII: see letter in col 2 from Mr Dennnis Powell

# Correspondence

*The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.*

## Commemorating the RFC

*From Air Chief Marshal Sir Philip Joubert,* KCB, CMG, DSO.

APRIL 1, 1962, will be the fiftieth anniversary of the formation of the Royal Flying Corps, Naval and Military Wings. Many of us feel that this is an occasion which should be suitably celebrated. I invite your support to the project outlined below.

On the due date a service of remembrance should be held at St Clement Danes Church. To this service should be invited survivors, officers and other ranks who served in the RFC and RNAS.

After the service a wreath should be laid with due ceremony at the Cenotaph. The Cenotaph is more appropriate than the RAF Memorial on the Embankment.

From the material held at the Imperial War Museum a short film should be prepared and shown on television to illustrate the work of both branches of the RFC.

So far as I have been able to discover, the Air Ministry's interest in such a celebration is limited to the production of a pamphlet. Perhaps the Air Council can be encouraged to take more appropriate action if this matter is ventilated in the Press. After all, it was on this date that organized military aviation came into being in Britain.

Ascot, Berks P. B. JOUBERT

*[The Royal Warrant was dated April 13.—Ed.]*

## Airship Costs

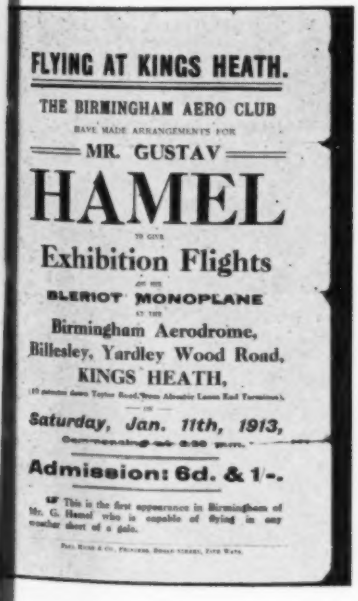
I FOUND Mr W. E. Casley's article (June 1) on R 34's double crossing of the Atlantic in 1919 very interesting indeed. Those airships, and the people who designed, built and manned them, created a chapter in human effort which I find enthralling.

Some of your readers may be interested in the cost of designing and building these incredible vehicles. The R 33 cost £350,000; R 36, £350,000; R 80, £275,000; R 38, £500,000; R 37, £325,000 (this airship was not completed); R 100, £350,000 (contract price); and R 101, £640,000.

Crews of airships were, in general, civilians. They were supplied with uniforms for which they had to pay. Caps and badges were supplied from public funds but were returnable when the individual left the airship service!

When R 100 flew to Canada it set out with 10,440gal of fuel aboard. It had 1,500gal left when finally moored.

Yeovil, Somerset J. A. SIZER


FLYING AT KINGS HEATH.

THE BIRMINGHAM AERO CLUB

HAVE MADE ARRANGEMENTS FOR

MR. GUSTAV

HAMEL

TO GIVE

Exhibition Flights

ON HIS

BLERIOT MONOPLANE

AT THE

Birmingham Aerodrome,

Billesley, Yardley Wood Road,

KINGS HEATH,

(5 minutes down Taylor Road, from Alcester Lanes End Terminus),

ON

Saturday, Jan. 11th, 1913,

Commencing at 2.30 p.m.

Admission: 6d. & 1/-.

N.B. This is the first appearance in Birmingham of Mr. G. Hamel who is capable of flying in any weather short of a gale.

PRINTED BY [illegible]

*Having read Mr Wansbrough - White's article "Flight," April 6) on the Bush aeroplanes of circa 1911, Mr H. Heath of Hollywood, near Birmingham, has sent us some snapshots (unfortunately unsuitable for publication) of himself flying a glider built by Birmingham Aero Club members in 1912. He also sends this old handbill; the small print at the bottom reads: "This is the first appearance at Birmingham of Mr G. Hamel, who is capable of flying in any weather short of a gale." In the event, deep snow precluded the exhibition. Incidentally, Mr Heath is 85 years of age—our oldest reader?*

## Polish Airmen's Week

*From Air Chief Marshal Sir Hugh Pughe Lloyd,* GBE, KCB, MC, DFC.

THIS month sees the 21st anniversary of the arrival of the Polish Air Force. In the perilous days of 1940 it would have been impossible to place a value on those Polish flyers already hardened in two campaigns. During the Battle of Britain and throughout the war they took their share in the fight in defence of our common cause: freedom. When the victory came over 2,000 Polish airmen had lost their lives. Of the survivors most remained in Britain, for there was no place for them in Poland.

Sixteen years ago saw the establishment of the Polish Air Force Association. This enabled help to be given to those who had fallen on hard times. Disability, illness, old age are responsible for lack of many essential needs. There are the orphans, the widows and the elderly parents. The Polish Air Force Association in Great Britain provides help in every genuine case, giving priority to those who do not qualify for the benefits of our Welfare State.

The amount of aid we can give is limited by the funds available. But I feel sure that your readers will be glad to lend their support to our Association, which is trying to repay the debt which we all owe to those who spared no sacrifice in those perilous days of 1940. All donations will be gratefully received and acknowledged. They should be sent to me at 14 Collingham Gardens, London SW5.

London SW5 HUGH LLOYD, Chairman of Appeal

## Biggest Jet-operators

REGARDING the news-item "TWA'S Big Jet Order" in the May 11 issue of *Flight:* If "BOAC is the airline which has the largest number of jets in service or on order" and "TWA will now have the second largest jet fleet outside the Soviet Union," may we assume that both American and United have been bought out by the Politburo?

San Bruno, Calif GORDON P. WOODMAN

[The score is as follows (number of jets in service and on order): BOAC, 89 (nineteen Comet 4, fifteen 707, fifty-five VC10); TWA, 77 (fifty-three 707, four 720, twenty Convair 880); American, 74 (twenty-four 707, twenty-five 720, twenty-five 727); United, 64 (fifteen DC-8, twenty-nine 720, twenty 727, with another twenty not yet firm). We cannot speak for the Politburo, but our original statement stands.—Ed.]

## Travelairjager

REFERRING to your interesting photograph showing the DH Tiger Moth "conversion" to a Fokker D.VII (page 299, March 10 issue), you might care to publish the enclosed photograph [above—Ed] showing another similar conversion for filming.

The aircraft shown is actually an old Travel Air Model 2000, owned by Frank Tallman and flown by him in the filming of "Lafayette Escadrille," in 1957. Mr Tallman started acquiring and restoring ancient aeroplanes as a hobby some ten years ago. He is now Paul Mantz's chief rival in Hollywood in providing both old-time aircraft and pilots to fly them.

Nairobi, Kenya DENNIS M. POWELL

## Two-stroke Engines

IN reply to Mr Maurice Austin's letter in today's (June 8) *Flight* asking about the first time a two-stroke engine was used in an aeroplane, I think it must have been the Baby Wright with an NEC engine. This was a V engine with separate pumping cylinders and was made by the New Engine Co.

The Baby Wright was a small replica of the Wright aeroplane without a front elevator and was made by Shorts. I well remember seeing Mr Alec Ogilvie flying one in the Gordon Bennett Cup Race at Eastchurch in 1911. It flew quite smoothly and finished the course, but was not of course placed as the aeroplane was too slow. This was the race in which Gustav Hamel took a terrific wallop and got away with it.

I think the main objection to the two-stroke for aeroplanes is heavy petrol and oil consumption.

Wembley, Middlesex C. L. WILLS

*Mobile secondary-surveillance radar unit, built to Ministry specification by Cossor Radar & Electronics Ltd, under MoA evaluation at London Airport*

**BY D. H. R. ARCHER, MA**

**(Cossor Radar & Electronics Ltd)**

# ATCRBS

## Developments in Secondary Surveillance Radar for Air Traffic Control

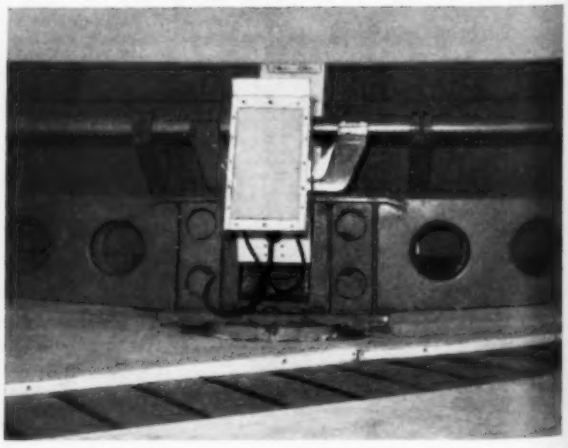
AFTER ten years of extensive technical and political activity the Air Traffic Control Radar Beacon System (ATCRBS) —the international secondary radar system for air traffic control—has at last reached the point of large-scale implementation. The subject has, of course, been widely discussed internationally, and the system now being implemented derives from that which was agreed upon by ICAO in 1957: the bulk of the experimental and development work, however, has been carried out in the UK and the USA and it is only in those countries that ground facilities are now available. Many airlines of other countries, though, have installed or ordered the airborne equipment and there can be little doubt that ground equipment will be extensively deployed in the near future. It seems appropriate at this moment, therefore, to take stock of the position and to consider some of the developments which may occur in the next few years.

It may be useful first to recapitulate some of the advantages of ATCRBS—or Secondary Surveillance Radar (SSR), as it is also called—since these need to be borne in mind when studying the prospects of the system. To the airline operator, the advantages are a decrease in the workload on aircrew—as a result of decreased requirement for position reporting—and the elimination of the need for special manœuvres to enable a controller to identify an aircraft; it is also to be hoped that the adoption of the ATCRBS and allied systems will result in a general improvement in traffic-control procedures, and especially in the handling of aircraft round busy centres, with consequent benefit to all concerned. To the traffic controller the system offers reliable radar cover at radio lines-of-sight up to 200 miles, positive and immediate identification, and an air-ground data link capable of handling some valuable procedural information and possibly of informing the controller of aircraft altitudes. A secondary radar display, moreover, is not cluttered by returns from terrestrial objects or from rain or other meteorological phenomena and the frequency band employed is low enough for there to be negligible attenuation of transmission by rain or cloud. Finally, the capital cost of the equipment is low, being but a small fraction of that for a primary radar installation affording comparable facilities.

It is apparent, therefore, that the system is an extremely attractive one. Indeed, the sole disadvantage is the need for a transponder to be carried in the aircraft, with a consequent small reduction in payload and a slight reduction of system reliability relative to that of a primary radar system; but this disadvantage has now been accepted by the airlines and the adoption of the system has been endorsed by IATA. Before the advantages can be adequately realized, however, there must be extensive implementation both on the ground and especially in aircraft, because no significant benefit can be derived until a group of aircraft forming a recognizable entity in terms of air traffic control has been fully equipped.

A step in the right direction has been taken by the Civil Aeronautics Administration in the USA. Although ground equipment which meets the performance requirements of the ICAO system is not yet available in that country for large-scale installation, a control system using earlier types of equipment has been established on a scale sufficient to warrant aircraft on certain routes being required to carry transponders. The effect of the CAA regulations so far made is such as to make it virtually obligatory for civil turbo-jet aircraft to have transponders (although as yet these need not comply with the sidelobe suppression requirements which will ultimately be mandatory) when flying over the USA, and the same will shortly be true of turboprop aircraft. In the UK, on the other hand, the decision has been to wait until new ground equipment became available before requiring aircraft to carry transponders.

*Rear view of the aerial array on the Cossor mobile equipment and (right) close-up view of the rearward-looking control aerial*



The first of these new ground interrogator-responsors, engineered to a Ministry of Aviation specification incorporating the ICAO requirements, has recently been installed at London Airport and it is to be expected that before long there will be a requirement for certain classes of aircraft flying over the UK to carry transponders.

These moves have a threefold importance. First, the adoption of the system anywhere and to any extent is a contribution to the general safety of air travel and is to be welcomed as such; secondly, the sooner the system is in widespread use—and the actions so far taken can only encourage such use—the more rapidly will data become available on which *procedural* development (which is embryonic at present) can be based; thirdly, the large-scale installation of capital equipment may check the headlong rush of some enthusiasts in the direction of greater and greater system elaboration.

Taking the highest common factor of the equipment most recently developed by those manufacturers who make airborne transponders, the aircraft installation (which comprises a transponder, a control unit and an aerial) has, among others, the following characteristics:—

(a) The ability to reply to two interrogation "modes" (the name given to the ground-air coding process, the term "code" being restricted to the air-ground transmissions). One of these modes (Mode A) is the same as one of the modes (Mode 3) of the military IFF Mk10 secondary radar system, which operates on the same interrogation and reply frequencies: the other (Mode B) is peculiar to civil aviation. Selection of the mode of interrogation to which the transponder will reply is by means of a switch on the control unit.

If all civil transponders in an area are set to reply on Mode A, therefore, and all military transponders are set to reply on Mode 3, a Mode A interrogation will cause *all* transponders in the area to reply, so that responses from all transponder-equipped aircraft can be displayed at once. Alternatively, by causing the civil transponders to reply on Mode B and the military transponders on Mode 3, civil or military aircraft can be interrogated at will. By using a technique known as "mode interlace," whereby interrogations on one mode are alternated with interrogations on another (the modes are characterized by the time interval between a pair of pulses in the interrogation—8 and 17 microseconds for A and B respectively) the ground equipment can interrogate all transponder-equipped aircraft in the area and display responses from civil and military aircraft on the same display or separately, according to the control requirements.

(b) The ability to transmit a coded response to an interrogation on either mode. The code is manually selected by a switch on the control unit and there is a choice of 64 codes, which are represented physically by the presence or absence of pulses in six possible positions between a pair of "framing" pulses. The framing pulses, which are always present in a response and always 20.3 microseconds apart, not only define the positions of the "information" pulses but also help the decoding equipment on the ground to distinguish between an aircraft response and a set of random pulses from some other source.

(c) The ability to transmit, in addition to the pulses forming the coded response and outside the code frame, a special identification pulse. The process of radiating this pulse is initiated by pressing a button on the control box, and the pulse is radiated with every response for a period of about a quarter of a minute thereafter—the long period being necessary to ensure that the period of rotation of the ground interrogator aerial is comfortably exceeded.

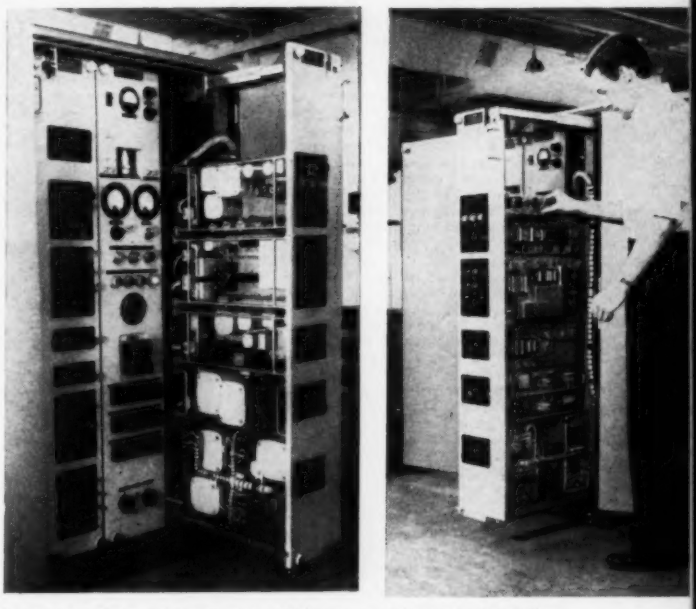
(d) The ability, upon interrogation by an appropriately designed interrogator, to distinguish between the main lobe of the interrogation radiation pattern and its sidelobes and to reply only to the main lobe interrogation ("sidelobe suppression"). Since no further mention of sidelobe suppression is made it may here be briefly noted (ref 1) that the advantages of this technique include a reduction in the transponder workload, the avoidance of confusion on ground displays which can result from the presence of incorrectly positioned responses to sidelobe interrogations, and a reduction in the total number of radiated responses in any area (with consequent reduction in the possibilities of interference with one ground equipment by responses from aircraft interrogated by another ground equipment).

These four characteristics, given suitable ground equipment and an aircraft fitment programme resulting in the installation of transponders in all aircraft in one or two classes (such as turbojet or turboprop aircraft, which can be distinguished from others by their cruising altitudes), provide an extension of existing radar facilities sufficient to justify immediate implementation. After the system has been in use in this simple form for long enough for the basic procedures to have been sorted out and internationally agreed, some of the possible extensions and elaborations can be considered for adoption. By then there will be more widespread knowledge of the system—practical experience of which is at present virtually confined to small groups of people in the UK and the USA—and there will be a better chance of its development in a generally acceptable direction.

At the same time, it is most desirable that those who are about to commit themselves to the purchase of equipment—particularly ground equipment, as the basic aircraft installation is already internationally standardized—should take note of the probable directions of system extension and make allowance for the possibility of their being introduced at a later date. Otherwise there is the danger of a situation—not unknown in the field of aviation electronics—in which a desirable development is balked by the existence of a widespread and heavy investment in a form of installation which is incompatible with the development in question. Some of the most important of the possible extensions are listed below, together with some comments on their present status:—

(1) *Additional Interrogation Modes:* Two further modes (C and D), for civil use only, are envisaged; provision for them is required in all current specifications. It is likely that Mode C will be used for obtaining altitude information from aircraft but the status of Mode D is as yet uncertain.

(2) *Additional Reply Codes:* By adding further information pulses between the framing pulses of the response the number of available codes can be substantially increased. For reasons of system compatibility during a transition phase, the only reasonably possible method of increasing the coding capability is by putting the additional pulses midway between the existing pulses—giving a total of 8,192 codes. It is extremely unlikely that so large a number will ever be used for procedural purposes; indeed, the present 64 codes appear to be more than adequate. On the other hand, 8,192 is too small a number for an airframe identification system—though it might be possible to devise a flight identification system within these limits. The most probable use appears to be for altitude telemetering purposes; although some experimental work is being done in this field using only 64 codes, there is a school of thought which advocates the use of a much larger number.



*Servo rack of ground equipment withdrawn to indicate serviceability, and (right) rear view of servo units, showing wired-in components*

A disadvantage of a substantial extension of the number of available reply codes by the addition of information pulses is the increase in the total number of pulses likely to be radiated in a given area during a given period. Such an increase must lead to an increased probability of false coding and other interference problems. This difficulty can, however, be overcome by accepting the lower coding capability—which is yet much greater than the 64 codes of existing transponders—resulting from using all the additional pulse *positions* but restricting the maximum possible number of information *pulses* to some low figure. Maximum protection against false coding can be achieved by using a constant number of information pulses (ref 2).

(3) *Automatic Selective Reply (ASR):* As already described, the interrogation mode to which the airborne transponder will reply is at present selected manually. Automatic Selective Reply is the name given to a technique whereby the transponder itself decides which interrogation mode is being used and replies accordingly; the idea is that the airborne installation will be set up to reply with a different kind of information on each mode, so that the ground controller can call off the information he requires by appropriately selecting the interrogation mode.

The principal application of ASR currently envisaged is for altitude telemetering. It is proposed that Modes A and B shall continue to be manually selected (ASR on Mode A is in any case undesirable, since it could result in civil transponders always replying to military interrogators operating on Mode 3) but that an interrogation on Mode C shall elicit a reply containing altitude information from an appropriately equipped aircraft (and no reply at all from any other aircraft) without the intervention of the pilot.

(4) *Altitude Telemetering:* The main technical features of this proposed development have already been described. In physical terms it is proposed that the facility shall be provided by the addition of a

*Aircraft aerial and (right) control unit for the Cossor SSR2A secondary radar system*

## ATCRBS . . .

separate small box of equipment, preferably mounted alongside the transponder. This box will accept inputs from the transponder and form a digitising link (ref 3) with the airborne altimeter and will feed out the appropriately coded response for transmission to the ground by the transponder.

Agreement has not yet been reached, however, on the method of coding to be employed. In the USA there is a tendency to favour a fine-grain system, giving altitude information in steps of the order of 100ft; in the UK the approach has been to try a preliminary evaluation of a coarse-grain system, using 64 codes only (ref 4), before deciding what the next step shall be. Some time must clearly elapse, therefore, before there can be an agreed international specification for the additional equipment necessary.

(5) *Lightweight Transponder:* As already noted, transponders are at present being fitted only in high-flying aircraft. It is to be expected, however (and it is certainly much to be desired), that the equipment programme will rapidly be extended to include other kinds of aircraft. But for the smallest aircraft the kind of transponder currently being installed, small though it is, is probably too large, complex and expensive to be made a mandatory fitment. Attention has therefore been paid, both in the UK and the USA, to the problem of devising a smaller transponder for such aircraft. In the USA the tendency is to emphasize the need for lightness but to permit little reduction in the facilities available. In the UK on the other hand, the view taken is that to achieve cost and weight reduction coupled with increased ease of servicing some reduction of facilities must be accepted; the limitations already imposed on aircraft likely to fit such transponders will probably compensate for the reduction in availability of information.

It should be observed that, since such small aircraft generally operate only within a single region (and frequently within a single country), the disparity of the UK and US views—reflecting, as it does, the difference in relative importance of "general aviation" in the two countries—does not mean that there is a problem to be resolved internationally. The matter is one which can be settled regionally, or even nationally; it is necessary only that an authority about to embark on a large-scale implementation of ATCRBS should consider what the policy is to be and to make arrangements accordingly.

It will be clear that of the items in this list of probable future developments the four with far-reaching international implications are largely concerned with altitude telemetering. Two conclusions can be drawn from this. First, that the need for further development centres largely on the altitude question—if some equally satisfactory method of obtaining altitude information were otherwise available the existing system would appear to meet all present and currently foreseen requirements; secondly, any aviation authority contemplating installing ATCRBS ground equipment will be well advised to take the possible advent of altitude telemetering into account.

In practical terms the question is whether altitude information is required at the relatively high data-rate which can be achieved by using secondary radar, or whether a lower data-rate—such as that which will probably be obtained with AGACS—will suffice. If a lower data-rate is acceptable it may be better to refrain from further elaboration of the ATCRBS; if not, secondary radar probably offers a better solution than does any other system. To say that a high data-rate is necessary, however, is to imply the existence of a sophisticated data-handling and display system capable of utilizing such information: this is tantamount to saying that the high-speed information input is likely to be required only in busy centres where such sophisticated equipment exists or is planned.

In this context it is useful to consider how ATCRBS can be integrated with other ATC equipment—especially with primary radar. At present, and for some time to come, the fact that not all aircraft will be carrying transponders must mean that secondary radar cannot replace primary surveillance radar as an ATC aid, but must be operated in conjunction with it. In busy areas, indeed, it is likely that there will always be a need for primary radar as a safeguard against transponder failure. At present the tendency is to lock the primary and secondary radars together—synchronizing their pulse recurrence frequencies and aerial rotation rates (even, in the USA, to the extent of mounting the ATCRBS aerial on top of that of the primary radar). This practice has the advantage of simplifying the problem of displaying the two sets of information in a way which permits them to be readily correlated; but it is otherwise undesirable, because only in exceptional cases are the optimum operating conditions the same for both equipments, and in other cases the performance of one or both must be degraded to effect the association. To obtain optimum results from ATCRBS it should as a rule be operated as an independent system and any association with the radar equipments should be effected by using modern display techniques. The employment of such techniques is in any case desirable if full use is to be made of the moding and coding facilities of the system, which make it possible to display different kinds of aircraft (and, with altitude telemetering, aircraft at different heights) on different displays and to sort and recombine them in a variety of ways (ref. 5). Apart from these considerations, however, ATCRBS can be associated, *mutatis mutandis*, with other ATC aids in the same ways as can primary radar; and, because it offers a reduction in the amount of R/T communication, it will ease the burden on communication channels and on air traffic controllers.

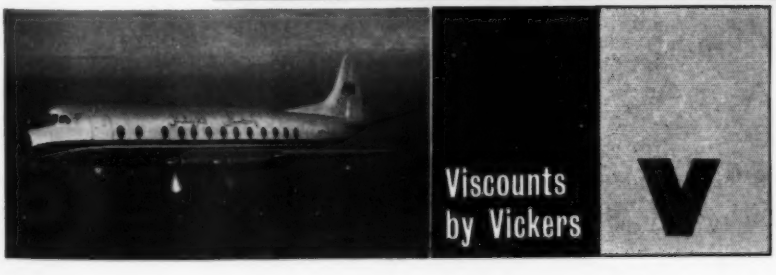
In conclusion, it may be said that the urgent need now is for a rapid and large-scale implementation of the system in its present form. The endeavours of workers in the field to improve and elaborate the system are to be both applauded and encouraged; but it must be recognized that the results of these endeavours cannot in the nature of things be translated into installed equipment for a time which must be measured in years rather than months, and it would be a tragedy if the possibility of future improvements were allowed to delay the widespread introduction of the basic system. What now exists is an internationally agreed system which offers substantial benefits to all concerned: the sooner those benefits are reaped, the better.

### REFERENCES

(1) For a fuller discussion see K. E. HARRIS, "Some Problems of Secondary Surveillance Radar Systems," *Journal of the British Institution of Radio Engineers*, Vol 16, No 7 (July 1956), pages 361-373. For a comparison of two-pulse (ICAO) and three-pulse (US/FAA) systems see *Ministry of Aviation (Tels II) Technical Note No 1* (D. G. Terrington), March 1960.
(2) K. E. HARRIS, *op. cit.*, pages 381-382.
(3) B. W. GLOVER, *British Communications and Electronics*, Vol 7, No 9 (September 1960), pages 676-680.
(4) D. G. TERRINGTON, *British Communications and Electronics*, Vol 7, No 9 (September 1960), pages 663-665.
(5) D. H. R. ARCHER, *Journal of the Guild of Air Traffic Control Officers*, Vol 2, No 4 (summer 1960), page 8.

### FORTHCOMING EVENTS

| | | |
|---|---|---|
| June | 24 | RN Air Station Arbroath: At Home. |
| June | 24 | Bristol Air Day. |
| June | 24-25 | RAeC: Invitation Rally for Members and Associate Members, La Baule. |
| June | 24-25 | Vichy Aero Club Rally. |
| June | 24-25 | "Wings of Joigny" Rally. |
| June | 24-25 | Coutances and Channel Central Aero Club: International Rally, Lessay. |
| June | 25 | Leicestershire Aero Club: At Home, Leicester/East Oadby. |
| June | 25 | Wolverhampton Aero Club: Competitions Day. |
| June | 30-July 3 | Palermo Aero Club: 13th Aerial Tour of Sicily. |
| July | 1-2 | RAeC: Invitation Rally, Deauville. |
| July | 6-8 | Italian Aero Club: International Aviation Contest, Rome-Turin. |
| July | 8 | RN Air Station Abbotsinch: At Home. |
| July | 8-9 | Vittel Aero Club: Doctor-Pilots' Rally. |
| July | 9-10 | Turin Rally. |
| July | 10-16 | Aslib Aeronautical Group: Annual Conference. |
| July | 13-15 | RAeC: Lockheed International Aerobatic Competition and King's Cup Air Race, Baginton. |
| July | 14-15 | Marseilles-Provence Aero Club: Rally, Mejane. |
| July | 14-16 | Aerial Tour of the Pyrenees. |
| July | 14-23 | Angers Gliding Week. |
| July | 15 | RN Air Station Culdrose: At Home. |
| July | 15 | RN Air Station Brawdy: At Home. |
| July | 15-16 | Pescara Rally. |
| July | 22 | RN Air Station Lossiemouth: At Home. |
| July | 22-23 | Basse-Normandie Aero Club: 13th International Rally, Flers. |
| July | 25-26 | Portuguese-Spanish Rally. |
| July | 27-29 | International Business and Touring Aircraft Competition, Kidlington. |
| July | 30-Aug 7 | Derbyshire and Lancashire Gliding Club: Northern Gliding Contest. |




**all depend on Wing De-icing Heat Exchangers by**

**Delaney Gallay**

Member of the Lindustries group

*Specialists in Heat Exchange and Heat Insulation for over 40 years*

**VULCAN WORKS, EDGWARE ROAD, LONDON, N.W.2**
**Telephone GLAdstone 2201**

**GOLDEN JUBILEE ISSUE**

# THE STORY OF HENRY POTEZ

*The famous French Aircraft and Aero-Engine Designer*

Published in English for the first time this superb Souvenir Issue has been prepared by the leading French aeronautical journal "AVIATION MAGAZINE." It includes 140 photographs—many never published before—and 25 G.A. drawings and cut-aways. . . It is, therefore, a MUST for collectors.

In addition, there is the first full-scale technical report of the new Potez 840 medium range executive airliner, which made its first flight at Toulouse in May, 1961.

The Potez Story relates frankly the struggles of the young constructor when he started 50 years ago; his first ventures —and the successes he achieved; the High Noon of the 'Thirties, with Coupe Deutsch success; the difficulties during pre-War nationalisation; the even greater difficulties under German occupation; and the post-War revival and plans for the Future.

This is a daringly candid story of a man whose motto in French Aviation has always been: To Adventure.

**DO NOT MISS THIS SUPERB SOUVENIR ISSUE. . . POST YOUR COUPON WITHOUT DELAY—ORDERS WILL BE DEALT WITH IN STRICT ROTATION—THE EDITION IS LIMITED AND WILL NOT BE REPRINTED**

CUT HERE

TO: EUROPEAN AVIATION PRESS LTD., 140 CROMWELL RD., SW.7

*Please send me the English Edition of " The Potez Story " for which I enclose P.O. for 3/- to include postage*

NAME (BLOCK capitals) .....

ADDRESS .....

.....

.....

P.O. No. _____

# Straight and Level

IT seems to me that there are really two British Air Line Pilots Associations—BALPA the trade union, which fights for better working conditions for its members, and BALPA the technical union, which fights for better safety standards.

I have a feeling, too, that it is the trade union faction which dominates, and which makes some pilots feel a little unhappy. For example, BALPA the trade union is now asking BEA for more money for Argosy crews—on the basis of the high productivity of the Argosy, which, they say, approaches that of the Vanguard.

Even if this were so, which simple arithmetic shows it is not, by many ton-miles per hour, I doubt the logic of the argument. If pilots' salaries are to be related to the ton-miles per hour output of the tools that the management put into their hands, the captains of supersonic airliners (as I seem to remember estimating some time ago) will be clamouring for salaries of about £25,000 a year. I agree that salaries should be related to productivity, but the productivity must be that of the pilot as well as of the new equipment which he flies.

● The F-104G must be the most internationally built aircraft in history. I remember noticing at Paris some rather uninteresting die-forged chunks of metal on the stand of Soc Métallurgique d'Imphy. Idly I began to read what they were, and was surprised to learn that they were fuselage frames and keels for Lockheed F-104Gs. From Imphy the rough forgings go to Nord-Aviation, where they are finish-machined. They are then shipped to the North, South and West groups responsible for manufacturing F-104s in Europe. Some go to Dornier at Friedrichshafen, who make the centre fuselage for South aircraft assembled by Messerschmitt; some go to Weser, who make the centre fuselage for North aircraft assembled by Fokker; and some will be sent to Belgium, and wind up on the West line at Fiat in Turin.

Altogether this F-104G programme seems to involve almost every aviation firm on the Continent; and it even embraces one company in Britain—not through any desire to co-operate on the part of the British Government, but because Martin-Baker Aircraft make the best ejection seats. Oh yes, I never mentioned the big Canadian and Japanese participation in the F-104G programme. Even the Americans are in on it.

*This picture appeared in a 1907 issue of "Autocar" and on the back of the original photograph is the caption: "Mr John Hall, a poor working man, walked 94 miles to London in order to show his model aeroplane which he says will solve the aerial problem." It never did: but nothing since has ever done*

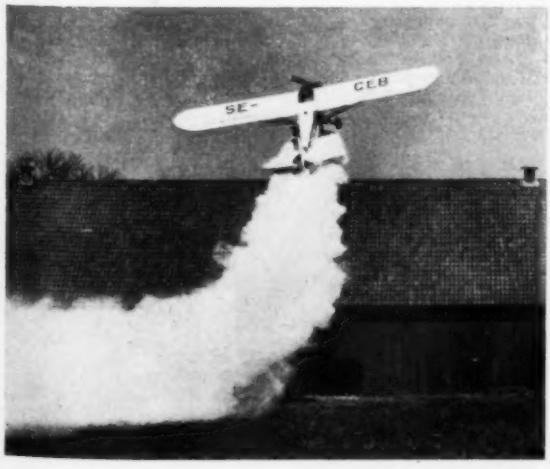
● I have only one complaint to make about the statement that the Ministry of Aviation issued last week concerning the near miss over London Heathrow last February (see page 880). The fact that they issued a statement at *all* is wonderful; that it should be an informative statement is truly to be welcomed in the cause of safety, no less so because it may never have appeared but for the constant badgering of the Ministry by the Press (all right, then, by one journal in particular).

My complaint? The use of the words "air miss." These crept into the language a few years ago, and I wish they'd creep out again. What's wrong with "near miss"? Or, if there is something wrong with it, what is the particular merit of air miss? Sounds like a stewardess to me.

● I think it was Theodore Roosevelt who used to say that whenever he met somebody he did not ask "How are you?" or "Aren't we having nice weather?", but "Have you read *The Wind in the Willows*?" He thought that the world was divided into two parts—those who had read that wonderful book and those who had not. He was thus immediately able to form an opinion of his new acquaintance.

My opening conversational item nowadays is: "Did you read Oliver Stewart's article about London Airport in the May issue of *Aeronautics*?"

I do hope you did. He describes it as the world's most hated airport, and he thinks that there must be something wrong with the English if they continue to suffer without protest the way in which the Ministry runs this airport. The article is so good that I believe it might have an effect on people in the Ministry who read it.




*Crop spraying? Well, it's all right for some, but for Swedish ex-wrestler Laroy Mansson, 42, it can be a crashing bore — enough to drive a chap up the wall in fact. I hope it was only the occupants of the building who hit the roof during this particular bout of Mansson's wrestling with the controls*

● You may remember Uncle Roger's disapproval of the whisky bottles at London Airport (this column, June 8).

A question was asked in Parliament on June 12, which *Hansard* records as follows:—

"**Mr Chetwynd** asked the Minister of Aviation why he approved the large advertisement for whisky immediately in front of the main terminal building at London Airport.

"**Mr Thorneycroft:** For money."

ROGER BACON

*Known as "Queen of the Arabian Skies," this all-white Canberra B.2 has been a regular mount for the AOC Air Forces Middle East, AVM D. J. P. Lee. During his two-year tour of duty at Aden the air vice-marshal, soon to relinquish his appointment, has flown over 100,000 miles in WH727 on visits to stations. He flies the Canberra himself on many trips, accompanied by his pilot and navigator, Flt Lt P. E. Goodband and Fg Off E. K. Thomson*

# SERVICE AVIATION

## *Air Force, Naval and Army Flying News*

**Transatlantic Soldiery**

MILITARY history was made at RAF Lyneham yesterday (June 21) with the first airlift to convey a British infantry battalion across the North Atlantic to take part in an exercise—called Pond Jump—with the Canadian Army. Britannias of Transport Command are being employed, and the airlift (from Lyneham to Fredericton, NB) continues until next Wednesday.

**Stamford Honours Wittering**

WITTERING, first V-force base in the RAF and for eleven years the home of the Central Flying School, is to receive the freedom of the nearby town of Stamford on July 1. The ceremonial presentation is being made by the mayor, the Marquess of Exeter, to the station commander, Gp Capt L. H. Trent, VC, DFC. This year marks the 500th anniversary of the granting of a charter to Stamford, which is 2½ miles north of Wittering on the Gt North Road.

**FAA Birthday Honours**

MEMBERS of the Fleet Air Arm honoured in the Royal Navy list in the recently published Queen's Birthday Honours are as follows:

ORDER OF THE BATH

*Companions:* Rear Admiral F. H. E. Hopkins; Rear Admiral C. B. Pratt.

ORDER OF THE BRITISH EMPIRE

*Companions:* Capt H. H. Brecon; Capt L. E. D. Walthal.

*Member:* Lt Cdr K. Sinclair.

Awards

*Air Force Cross:* Lt Cdr T. C. Evans.

*British Empire Medal:* Ch Eng Art G. W. Carling; Ch Elec Art(A) F. L. J. Crouch; CPO (A/Art 1st Cl) R. W. Holton; CPO (Acwn 1st Cl) S. W. Lock.

*Queen's Commendation for Valuable Service in the Air:* Lt Cdr T. E. M. Kirby.

*Gp Capt A. H. Hewitt, OBE, AFRAeS, who as a Deputy Director of Operational Requirements will be in charge of space matters for the RAF (see "Flight," June 8, page 796)*

**Keeping 601 Together**

AN active Old Comrades Association is sustained by members of the disbanded 601 (County of London) Sqn, RAuxAF, and those already in the association are anxious that potential members should be informed of its whereabouts and activities. Headquarters are at the Chevrons Club, Dorset Square, Marylebone, London W1; hon secretary is Mr W. J. Kentish, 35 Floriston Court, Whitton Avenue West, Northolt Park, Middx. The OCA's next big event is the laying-up of the squadron standard in St Clement Danes Church, probably this autumn.

**RAF at Bisley**

THERE was good weather for the annual RAF Small Arms Association meeting at Bisley last week, when 653 competitors took part.

A surprise turn of fortune made the final part of the competition for the Queen's Medal most interesting. At the close of the first stage Flt Lt L. A. Wood led with 178 points, WO F. Flanagan lying second with 176. Flt Lt B. Hassell was 11th with only 162. While the competitors were shooting off the final event, snapshooting at 300yd, WO Flanagan required 38 out of a possible 50 to win; he got the very high score of 46—six bulls and four inners. Flt Lt Hassell pulled up to take second place and Flt Lt Wood became third. WO Flanagan was chaired in the traditional fashion and marched off with musical honours. Results:

*Queen's Medal, Championship and Sutherland Cup:* 1st, WO F. Flanagan, 347; 2nd, Flt Lt B. Hassell, 338; 3rd, Flt Lt L. A. Wood, 331. *Small Arms Efficiency Cup:* Flt Lt L. A. Wood, 524. *Revolver Championship and Barton Cup:* Flt Lt Pocock, 203. *SMG Championship and Ivelaw-Chapman Cup:* Flt Lt J. E. S. Rolfe, 251. *WRAF Rifle Championship:* WO(W) Beswick, 135. *Rifle Championship (SRb):* Gp Capt A. B. Riall, 262. *Inter-Command: Rifle (SRb):* 1st, Fighter Command, 1,068; 2nd, FEAF, 1,058; 3rd, Technical Training Command, 1,054. *Revolver:* 1st, Bomber Command, 720; 2nd, NEAF (Cyprus), 713; 3rd, Flying Training Command, 709. *SMG:* 1st, Maintenance Command, 870; 2nd, Flying Training Command, 865; 3rd, Fighter Command, 862. *Inter-Station: Rifle (SRa):* 1st, Hemswell, 853; 2nd, Brampton, 845; 3rd, Cranwell, 845. *Rifle (SRb):* 1st, Boscombe Down, 537; 2nd, Brampton, 536; 3rd, Coningsby, 535. *Revolver:* 1st, Oakington, 371; 2nd, Brampton, 359; 3rd, Hemswell, 342. *SMG:* 1st, Stafford, 457; 2nd, Boscombe Down, 455; 3rd, Oakington, 429. *Inter-Squadron: Rifle (SRa):* 1st, 103 Sqn, 581; 2nd, 33 Sqn, 565; 3rd, 220 Sqn, 549. *Revolver:* 1st, Fighter Command Communications Sqn, 259; 2nd, 220 Sqn, 250; 3rd, 103 Sqn, 250. *Old Comrades:* 1st, N. E. C. Molyneux, 139; 2nd, Mrs B. K. Parsons, 136. *RAuxAF and RAFVR:* 1st, Cdt Plt Lane, ULAS, 135; 2nd, Plt Off Sheridan, ULAS, 134. *University Air Squadrons:* 1st, ULAS, 774. *Apprentices and Boy Entrants: Rifle Team:* 1st, 3 Sqn, 1 Wing, Halton, 329; 2nd, Admin App School, Bircham Newton, 328; 3rd, 2 Sqn, 1 Wing, Halton, 319. *Individual Rifle:* 1st, A/App Moore, 91; 2nd, A/App Russell, 88; 3rd, A/App Moss, 88. *Young Officers' and Airmen's Challenge Cup:* 1st, Fg Off C. E. Ambrose, 166; 2nd, SAC K. S. Green, 165; 3rd, SAC Small, 156. *Rothermere Shield:* 1st, Flying Training Command; 2nd, Fighter Command; 3rd Technical Training Command; 4th, Bomber Command; 5th, FEAF; 6th, NEAF. *Air Officers SMG Match:* 1st, AVM W. E. Staton, 75; 2nd, AVM G. Bearne, 70.

*CO of 3 Sqn, RAAF, Wg Cdr R. H. Glassop (left), and two of his pilots, Fg Offs M. Loves and P. Dunn, with the first of their Sabres to wear white stars/red tail insignia*

*Air Chief Marshal Sir Edmund Hudleston, VCAS, congratulates WO F. Flanagan (see "RAF at Bisley")*

*Parliament, near which the Boeing Vertol 107 prototype demonstrator is seen here flying on June 9, may soon be asking questions about BEA's reported decision to import this helicopter (though probably not its T58 engines) in preference to a British product. On board for this flight, during which a landing was made on the Thames near Westminster Bridge, was Mr A. H. Milward, BEA's chief executive. The aircraft was flown by Capt J. A. Cameron, BEA's chief helicopter pilot*

# AIR COMMERCE

## D.H.126 IN THE NEWS

FOR some months now it has been an open secret that de Havilland Aircraft have been testing market reaction to what might be broadly termed a 30-seat DC-3 replacement with two rear-mounted turbofan jets—the smallest jet airliner (as opposed to jet executive) yet attempted. Among the operators who are on record as having shown interest are Airlines of New South Wales, a subsidiary of Ansett-ANA, and Trans-Australia Airlines (*Flight*, May 25, page 725). So far, de Havilland have volunteered no information, but at Hatfield last week, while the Press were asking senior officials of United Arab Airlines about their plans for the future, the subject of the D.H.126 was raised.

The question that brought this new project into the news, directed to UAA, was: "Do you intend to replace your Viscounts with a small jet, and if so, what?" The answer came from Mr Hussein Tewfik, deputy general manager of the airline: "Yes, we want to buy the D.H.126." Asked how many and when, Mr Tewfik said UAA would need seven to replace six Viscounts in 1964. During the ensuing exchanges, it was said that the price being quoted was about £190,000.

Mr H. G. Sturgeon, managing director of de Havilland Aircraft, said that the decision to produce the aircraft "hangs on the optimum size." He went on: "We want a design easily optimized to suit all airlines, because of the difficult economic problems you run into in aircraft of this class, which has to operate stages of up to five or six hundred miles." It was not an aircraft likely to be ordered in large batches—orders of five to 15 at a time might be typical of the kind of business they would do. In appearance the D.H.126 resembled the D.H.125, though of course it was larger.

In reply to a question, Mr Sturgeon thought it reasonable to assume that an aircraft of this class would get Government support. The D.H.126 had already been through the TASG [Ministry of Aviation Transport Aircraft Study Group] and had, he thought, been well received. The TASG had received presentations of the D.H.121, D.H.125 and D.H.126 at the same time.

Asked whether Viscounts would be accepted in part exchange for D.H.126s, Mr Sturgeon said: "We think that airlines will be able to realize a better second-hand price than we could." Aircraft manufacturers were not dealers and, after all, people who wanted second-hand cars didn't always go to a dealer. Would the engine be the Rolls-Royce RB.172? Mr Sturgeon said that no decision had been made, but "we have got to have a specific approaching that of a piston engine." During the course of the exchanges it was evident that Rolls-Royce, Bristol Siddeley and de Havilland are all offering new turbofan engine designs for the D.H.126.

[*UAA and the VC10: page 880.*]

## LORD DOUGLAS RE-APPOINTED

LORD Douglas of Kirtleside, chairman of BEA, has accepted the invitation of the Minister of Aviation, Mr Peter Thorneycroft, to continue as chairman of the board until December 23, 1963, when he will be 70. He became chairman in March 1949, having joined the board little more than four months earlier, and his present appointment was due to end in March next year.

## FARE-FREEZE THAW?

LIKE some Yeti of the Himalayas, material diversion continues to leave its tracks on air transport, inspiring myths attributing exaggerated and even fearsome powers to it, although to many people it is more of a shadow than a substance. Certainly our Air Transport Licensing Board must soon be wishing that the phrase had never found its way into the new Act.

What is not always realized is that it is possible for an airline to cause material diversion from its own scheduled traffic by offering attractive group charter rates on non-scheduled flights in depreciated piston-engined equipment—a class of business into which they have been driven by charter operators like Flying Tiger, Seaboard, Riddle and Cunard Eagle. The number of transatlantic charter flights between the USA and Europe has grown immensely since 1957. In that year there were just over 500 flights by scheduled and non-scheduled carriers, compared with more than 1,500 in 1960. In terms of passengers, not quite 39,000 people availed themselves of transatlantic charter flights in 1957 compared with nearly 130,000 in 1960. Of these about one-third were carried by US operators.

IATA is beginning to be seriously concerned at the diversion from scheduled services, and an "informal" meeting of 16 airlines in New York on June 2 is to be followed by what has been described as a "crucial conference" in London on July 18 of the 18 transatlantic IATA carriers to discuss proposals for meeting group charter competition with their own group charter rates.

Several IATA carriers are already very much in the group travel business: BOAC, for instance, has been operating something like two DC-7C or Britannia charters a day in the 1960 and current summer seasons, and flew more than 31,000 non-scheduled hours in 1960 compared with little more than 13,000 hours in 1959. It can hardly be doubted that these charters have diverted some traffic from scheduled services as well as having generated entirely new traffic that could only have flown at group rates. BOAC's western routes are not getting the traffic to match the huge increases in capacity, and this is attributed by BOAC to the American trade recession and President Kennedy's reference to America's foreign exchange shortage, leading Americans to fly PanAm and TWA.

BOAC has nearly 50 per cent more seats for sale on the US routes this season but business has increased by only 10 per cent so far. "All Atlantic carriers are in the same position," says BOAC, "and there are still empty seats right through the peak season on all airlines."

Load factor on the North Atlantic for all IATA carriers was down by no less than seven points in 1960 over the 1959 figure, a result of excess capacity on scheduled services and a consequence, no less dire for having been predicted years ago, of the introduction of big jets. The natural growth of group charter as a fourth, sub-economy class has resulted in several proposals from IATA carriers for this category of traffic. TCA has proposed a £71 London - Montreal return fare for groups numbering 45 upwards against the current £163 jet economy fare. BOAC is said to be not so keen on this, on the grounds that parties not large enough for charter could be carried aboard ordinary scheduled flights in the same cabin as individual passengers who are paying much more than group rates. (This, it will be recalled, is how BEA got into the independents' inclusive-tour business in 1959.) Also envisaged by IATA, so it is reported, is a 23-day excursion fare of £107 applying all the year round, instead of only in the off-season, giving the tourist an extra six days over last winter's 17-day £125 London - New York jet excursion fare.

It seems that the two-year "fare-freeze" agreed by IATA at Cannes last October is having to be reconsidered as jet load factors continue to fall at an alarming rate. BOAC say frankly that the choice now before them lies between cutting schedules or selling harder. The corporation has chosen to sell harder.

*The first of six Viscount 828s for All Nippon Airways being handed over at Wisley on June 12. These aircraft will seat eight first-class and 55 tourist passengers, with a rear lounge for four. Carry-on luggage space and Bendix weather radar are also features. All Nippon have been operating two chartered Viscount 744s pending delivery of their own 828s*

## AIR COMMERCE . . .

### ICAO ADOPTS v.g.p.i.

BRITAIN'S visual glide-path indicator, the RAE/Calvert-developed red/white approach system, has been adopted by ICAO as a world standard. Rather confusingly, ICAO calls the system a visual approach-slope indicator, but it is still the v.g.p.i. familiar to pilots landing at London Heathrow since June 1959. The system was described in *Flight* for August 15, 1958.

The Ministry proposed v.g.p.i. as a world ICAO standard in 1959, and worked closely with the Federal Aviation Agency in helping the Americans to evaluate it. This led last year (*Flight*, November 11, page 758) to a decision by the FAA—after extensive tests at the National Aviation Facilities Experimental Center at Atlantic City—to recommend the system as a US standard. Once it had been accepted by the FAA its adoption by ICAO was only a matter of time. The system will become a world standard on October 1 unless, as seems unlikely, a majority of the 86 member-nations disapprove.

There remains the question that all governments will ask: How much does it cost to install? In the USA it can be introduced for about $10,000 at airports with runways which already have an approach lighting system, and for about $30,000 on other runways. A simplified version for use on smaller airports, which the FAA say is quite satisfactory, can be installed for as little as $1,500.

The patent is held by the UK National Research Development Corporation. Thorn Electrical Industries are among the approved UK manufacturers, and have already done installations in Australia, Switzerland and Dutch New Guinea. The US firm of Sylvania Electric Products, with whom Thorn have had interchange in the lighting field, manufacture the v.g.p.i. system in the USA. Other manufacturers include GEC and Research Engineering.

### LORD WINSTER

WE regret to record that Lord Winster, Minister of Civil Aviation from August 1945 to October 1946, died on June 7 at the age of 76. As Minister responsible for building up British air transport in the difficult months just after the war, he was a firm believer in the extension of Commonwealth air services and in cheaper air travel. He travelled widely abroad, and in 1946 attended the Pacific Civil Aviation Conference at Wellington, New Zealand.

Lord Winster left the MCA before his work had had time to bear full fruit, but he was largely responsible for the Anglo-US Bermuda agreement of 1946 and for laying the foundations of the Civil Aviation Act. As Mr Bulwer-Thomas, his Parliamentary Private Secretary, writes in *The Times:* "The independence of the airline corporations meant that he could not direct but had to persuade; and the personalities in civil aviation at that time were as prickly as could be found anywhere. Fortunately Winster was at his best in human relationships; his only failure was in handling the Civil Aviation Group of his own party, and not even the Archangel Gabriel could have succeeded there."

### CENSORED VOICE OF THE GUILD

MOST air traffic control officers, being civil servants, are not free to speak on professional issues as they like without official permission and guidance. Mentioning this at the recent dinner of the Guild of Air Traffic Control Officers, Mr Arnold Field, Master of the Guild, said that although the difficult problem of the Guild's voice in public was still *sub judice*, 70 per cent of GATCO members are civil servants whose freedom of public speech on professional issues was restricted. Mr Field felt that perhaps regulations framed so long ago should be amended on a more rational basis and one more in keeping with 1961.

The Master awarded the Hunt Trophy for 1960 to Gp Capt "Jimmy" Jeffs to mark the Guild's appreciation for his services over the years to ATC. A founder-member of the Guild, "Jimmy" Jeffs was appointed by BOAC to travel ahead of the Royal Tour of India last year to ensure safe ATC arrangements for the Royal aircraft. A presentation was also made to the Pathfinder Association in appreciation of their co-operation extended to the Guild in its formative years.

### WHERE ONE AIRLINER EQUALS TWO

AUSTRALIAN experience provides European operators with an idea of what life would be like if summer were to last the whole year round. The Department of Civil Aviation has recently published its annual survey of utilization rates for regular air services by Australian airlines and these show the extent to which utilization rates down under are up over.

Annual rates for DC-3s—the mainstay of Australian aviation in past years—have always been phenomenal. For this type, 1960 continued to show remarkable figures, with Mac.Robertson Miller's five DC-3s averaging 2,326hr annually, and two Sydney-based carriers, Airlines of New South Wales and East-West Airlines, each averaging over 2,000hr with fleets of six and four DC-3s respectively. Annual utilization rates of other piston-engined types are also well above average, with Ansett's five Convair 440s almost touching 2,700hr, with the four DC-6Bs operated by Ansett and TAA each averaging about 2,450hr.

But it is on the turbine equipment that the highest rates are being achieved. TAA and Ansett exceeded 10hr daily throughout 1960 on each of their six Electras, while Mac.Robertson Miller achieved the remarkable figure of 3,807hr in 1960 with their single F-27. Also over the 3,000hr mark were Qantas' seven 707s.

The following figures, taken from the survey published by the Department of Civil Aviation, show how Australia's turbine aircraft are working double-time:—

| Aircraft | Carrier | No of aircraft | | Average block speed (m.p.h.) | Average stage-length (st. miles) | Average utilization (hr/yr) |
|---|---|---|---|---|---|---|
| | | at year-end | average | | | |
| Boeing 707 | Qantas | 7 | 7.0 | 451 | 1,775 | 3,128 |
| Electra | TAA | 3 | 2.8 | 304 | 545 | 3,728 |
| | Ansett | 3 | 2.9 | 304 | 539 | 3,835 |
| | Qantas | 4 | 3.4 | 320 | 1,605 | 2,258 |
| Visc 800 series | TAA | 2 | 2.0 | 236 | 307 | 2,785 |
| | Ansett | 5 | 4.3 | 251 | 368 | 2,768 |
| Visc 700 series | TAA | 10 | 10.5 | 239 | 454 | 2,592 |
| | Ansett | 5 | 4.5 | 238 | 412 | 2,246 |
| F-27 | TAA | 9 | 8.5 | 182 | 183 | 2,208 |
| | Ansett | 6 | 5.3 | 201 | 203 | 2,938 |
| | Mac.Rob Miller | 1 | 1.0 | 207 | 280 | 3,807 |
| | East-West | 1 | 1.0 | 174 | 171 | 2,881 |

*The exterior of the FAA's "mobile lounge" illustrated in last week's issue contains this spacious interior—in effect a self-propelled terminal. A curious feature of modern air transport is that the aeroplane becomes less mobile while supporting ground installations become more so*

*An important milestone in Luton Airport's history will be a conference next September to decide whether Customs facilities shall be retained there, or withdrawn through insufficient use. Luton Corporation has spent £800,000 on improving this airport, which it considers to be one of the best outside London (one hour away by road). There were 29,232 movements at Luton in 1960, of which 1,051 were commercial*

## TAXI FROM PRAGUE

THIS month marks the tenth anniversary of Czechoslovak Airlines' inauguration of an air taxi service, plying from 18 main centres to some 70 towns and cities. It is chiefly sustained by Morava L-200As, and to celebrate the anniversary and publicize the service to UK tourists, CSA flew one of these aircraft all the way from Prague to Gatwick last week to give demonstration rides. *Flight* was thus enabled to see how the Morava worked when fully loaded. (In "Handling Notes from Coventry," our issue of May 4, it had been described as "a tractable, businesslike aeroplane, not very subtle, but very economical").

At Gatwick, OK-OFA was flown by Vostech Kárník, chief pilot of the air taxi services; he had with him Zdenek Kovár, chief navigator of CSA, to deal with R/T procedures. This meant that the Morava was restricted to three passengers, against a normal complement of four. As the other two were fairly big people, it also meant that there was not much elbow-room on the rear bench-type seat. (Three smallish Labour MPs, who had the next ride, probably found themselves quite at home in a back-bench configuration.) There was also a good deal of floor-vibration on take-off and climb. Against this, the L-200A has good all-round visibility; and on a straight run to Brighton it cruised along quite happily at an indicated 250km/hr (155 m.p.h.) with 625mm Hg and 2,350 r.p.m. With the port engine temporarily feathered on the way back, we seemed to be maintaining height comfortably at 200km/hr (124 m.p.h.) with 750mm Hg and 2,350 r.p.m. on the good engine.

Cost of air taxis to the Czechs is Ckr2.60 per km (approximately 2s 5d per mile). For English tourists, who get 40 instead of 20 Czech crowns to the £, it works out at about half this amount. Last year, it seems, Czechoslovak air taxis carried over 18,000 passengers; and for the decade since their inauguration the total is 152,728.

## "MASS TRIAL" BY THE BOARD

SIXTEEN applications for licences to operate flights from England to the Canary Islands, in connection with inclusive tours during the winter months, had been set down for hearing at Meeting 15 of the Air Transport Licensing Board on June 12.

Five of the applications were from British United Airways, and were unopposed; one was withdrawn before the hearing; one was postponed for lack of a witness; one, for three flights only, was unopposed; and the remaining nine, from seven different carriers in association with nine travel agencies, were opposed in objections entered by British United Airways, mainly on the grounds of diversion of traffic from their own scheduled services.

It had become obvious, from the crowded programme for this and future ATLB meetings, that some system would have to be evolved to expedite the hearings. The procedure accordingly adopted was for the objector to state the general grounds of the objection to all applications opposed after the presentation of the case for the first applicant. Thereafter the proceedings consisted of the presentation of applications and the examination and cross-examination of witnesses, after which came the final statement for the objector and the applicants had the right of final reply.

This "mass trial" technique worked well, spared the Board the necessity of listening to the same objection repeated *ad nauseam*, and permitted the hearing of 14 applications—with brief allusions to two others—in the space of two-and-a-quarter hours, an average of less than ten minutes per hearing.

In case it should be thought that this was a rather cavalier and confusing way of dealing with matters affecting the livelihood of the operators and the holiday plans of thousands of people, it is pertinent to recall that the Board will have the transcript of the proceedings available to them when considering their decisions.

It was, perhaps, unfortunate for British United Airways that the grouping of the cases at this particular meeting also made it necessary for their representative to switch from objection to application and back again to objection in such a comparatively short time. The lack of cynicism with which he did so was admirable, as was his astuteness in taking his dilemma by the horns and being the first to use the phrase "dog in the manger."

## NINE MINUTES TO TENERIFE

WHAT must have been a record was set up by the Board in a recent hearing, lasting only nine minutes, of a British United application. This was for a variation of the licence for BUA's service to Las Palmas to include Gatwick as an alternative to London Heathrow, and Tenerife and Fuerteventura as alternative terminals, with a call at Gibraltar; permission to operate DC-6As, Britannias, Tridents or VC10s was also sought. The BEA/Gibraltar Airways objection to the stop at Gibraltar was withdrawn because British United had, in a letter of June 2, withdrawn their application for this stop.

Mr Kenneth Davison of BUA stated that when a licence for this route had been granted by the ATAC, Tenerife's radio facilities were not satisfactory and so this terminal was excluded for the time, but facilities were now satisfactory and BUA had already operated charter flights there; Fuerteventura airport was not yet available to Viscounts. Rather more than half the traffic carried to Las Palmas was destined for Tenerife, which had more hotels than Las Palmas. More than 50 per cent of the total traffic to the Canaries was for Tenerife, and about half of that was carried by BUA. Load factor had so far been 41 per cent, but this was an off-season figure as the Las Palmas route had only been in operation since March. Permission was also sought to substitute the BAC-111 for the Trident as an alternative type on this route.

## OVERSEAS BUYS TCA NORTH STARS

OVERSEAS Aviation has acquired 15 Canadair North Stars from TCA, which has for some months had its fleet of 21 of this type up for sale. This addition to its existing fleet of five Argonauts and seven Vikings will give Overseas one of the biggest piston-engined fleets of any British independent, and will certainly make it the largest owner of Canadair DC-4Ms in the world. A large quantity of spares, including Merlin engines, has also been purchased, and the general manager of Overseas Aviation, Mr Ernest Hessey, says that the North Stars have been bought in response to the growth in long- and short-haul charter work, and in anticipation of future needs when scheduled services begin. (Overseas' applications for new European routes are at present being heard by the Air Transport Licensing Board.)

It remains to be seen whether Overseas will operate all 15 North Stars; some might be disposed of to the company's Danish associate, Flying Enterprise AB, and Overseas could supply spares to any other operators of the type.

TCA North Stars operate the "Flying Merchant" all-cargo services across Canada and, until recently, flew passenger services in Canada and to Bermuda and the Caribbean. The financial arrangements are not revealed. Overseas intends to start services soon between Gatwick, Manchester and Prestwick with ex-BEA Elizabethans acquired last year.

*As recorded in a note on this page, the Gatwick-based independent Overseas Aviation has bought 15 DC-4Ms from TCA. The airline already has a fleet of five ex-BOAC DC-4M Argonauts and four others are operated by its Danish associate Flying Enterprise. This is a recent picture of one of the Argonauts in the airline's red and blue colour scheme*

*At a ceremony at Hatfield on June 12 Mr H. G. Sturgeon, managing director of de Havilland Aircraft, handed to Mr Hussein Tewfik, deputy general manager of UAA, the documents of the airline's fourth Comet 4C, one month ahead of contract date. On the left are HE Minister Extraordinary and Plenipotentiary of Yemen, and HE Mohamed Awad El Kouny, Ambassador of the United Arab Republic in London. UAA's Comets, which went into service in July 1960, have been averaging seven hours' flying a day. Cairo - London frequency was increased from five to seven a week yesterday, June 21, and new routes to the Far East and to Moscow are envisaged*

## AIR COMMERCE . . .

### UAA AND THE VC10

A POSSIBLE order for five Vickers VC10s is being seriously considered by United Arab Airlines. On Monday of last week Mr I. H. Gazarine, UK manager for the airline, and Mr Shehab El-Din, chief engineer, visited Weybridge to see VC10 production and to discuss the possible order. This news came to light at a press conference at Hatfield that followed acceptance by UAA (see photograph above) of a new Comet 4C, the fourth of their order for five and the first of the airline's repeat order.

A question was asked about the talks due to begin in Cairo on July 17 about UAA's request for traffic rights between London and New York. Mr Gazarine said that the possible order for VC10s was not a bargaining counter in this context. He was also asked whether the Ministry of Aviation had not in fact agreed in principle to UAA's request for fifth freedom rights between London and New York. This was not so, he said; it was apparently the opinion of the Ministry that there were already too many carriers on the route.

### UP-TO-DATE WITH EL AL

A NET profit of 500,000 Israeli pounds (£100,000) was made by El Al in the 1960-61 financial year, and this carrier's transition to turbine power will be complete when the three Boeing 720Bs ordered are delivered in 1962. They will replace the ageing Constellations, and could be used on future El Al routes that are being planned in Africa and possibly to the Far East. The first of three 707-420s has now been delivered, replacing the 707-420 leased from Varig to start jet operations in January, and the two remaining Constellations, will be used mostly for special and charter flights. Britannias will continue to operate scheduled services.

El Al has increased its turnover compared to capital investment to an extent rivalled by few other Israeli industries. In the latest financial year turnover was 131.5 per cent of capital, and in 1965-66 the airline expects to turn over its capital twice—certainly a commendable achievement in the face of increasingly strong jet competition. Cost per capacity ton-mile has steadily decreased from 48d in 1956-57 to 45.7d in 1959-60 and 42.4d in 1960-61. This matches closely the reduction in revenue from 54.3d per ton-mile in 1956-57 to 45.7d at present, and improved load factors have enabled El Al to increase its profit from the 1959-60 figure of 60,000 Israeli pounds (£12,000). Average utilization was exceptionally high at well over 11 hours daily, El Al's Britannias achieving a world record in utilization.

Sales promotion has been directed at persuading Israeli workers and managements of the benefits of winter travel, and a new service to Frankfurt is to be opened this winter. Regional offices for South America are to be opened in Buenos Aires, and for Central America in Mexico City. Passengers carried are expected to total 135,000-140,000 during 1961-62, an increase of nearly 40 per cent on 1960-61.

### THE HEATHROW NEAR MISS

ON February 21 last the pilot of a United Arab Airlines Comet 4C complained of a near miss in the London control zone. The other aircraft turned out to be a Trans-Canada Air Lines DC-8. For two months after the incident the Ministry, when asked whether the results of their investigation would be published, would say no more than: "It is not normally the practice to publish the findings of investigations into this type of accident."

In view of the seriousness of the incident this reply was obviously unsatisfactory. A question was asked in the House of Commons, when the Minister did not rule out the possibility of the findings being published; it depended, he said, on the outcome of the necessary consultations with the governments of the two countries concerned.

The Ministry is to be warmly complimented on the statement that it issued last week, which not only says what happened, but says that the circumstances are being promulgated:—

"The Ministry of Aviation investigation into the circumstances of the air miss involving a Comet 4C of United Arab Airlines and a Douglas DC-8 of Trans-Canada Air Lines, approximately three miles west of Epsom, on February 21, 1961, has been completed. This shows that the DC-8 was at the time of the accident above the height of 4,000ft to which it had been cleared by air traffic control and had, owing to a misunderstanding in the cockpit, continued to climb through the 5,000ft level allocated to the United Arab Airlines Comet, inbound to London Airport from Zürich.

"The circumstances have been brought to the attention of the Canadian authorities and as a result of the incident a re-examination of cockpit procedures employed by Trans-Canada Air Lines in its Douglas DC-8 aircraft was instituted with a view to ensuring that a similar incident does not recur.

"The Canadian Department of Transport is satisfied on the information provided to it that if an error was made by the pilot of the aircraft it was the result of cockpit procedures employed by the airline rather than one of negligent omission or commission by the pilot. It is the Canadian Department of Transport's intention, therefore, to ensure that cockpit procedures currently employed on all such aircraft used by Canadian airlines remain under active examination to ensure that maximum safety procedures are employed and maintained.

Measures have been instituted by the airline to eliminate the possibility of a recurrence of this nature. The circumstances of the incident are being brought to the attention of other operators and pilots."

*Seen at Tel Aviv in the first of El Al's three Boeing 707-420s, which replaces the 420 leased from Varig to start services last January. A note on the Israeli airline appears on this page*

*Thereby hangs a tail: this is a Flying Tiger freight loader's view of the CL-44's capacious hold. Tiger took delivery of their first aircraft, as previously recorded, on May 31. The striking paint scheme on the fin comprises a white T on a red disc encircled in white and blue*

## KLM ELECTRA ACCIDENT

THE KLM Electra that crashed at Cairo on June 12 (*Flight* last week) with the loss of 19 people out of 29 passengers and seven crew broke in two after hitting the top of a sand dune about three miles south of the airport during its approach. Both parts skidded about 350 yards through the sand and caught fire. Capt K. J. Reynolds, the pilot, was among the 17 survivors taken to hospital; the Dutch co-pilot was killed and the flight engineer, purser and a stewardess were injured. Two of the stewards are missing.

The Electra was flying via Rome to Cairo, Karachi, Rangoon and Bangkok, and had taken on eight passengers at Rome. Police searched the area for gold ingots on board the Electra; most were recovered, but a shipment of Swiss watches on board was scattered and broken. KLM have stated that the accident was not caused by any of the shortcomings which have previously afflicted the Electra.

## £1,600 AN HOUR Il-18s?

EMIL Frost, a leading official in the Deutsche Lufthansa of East Germany, recently fled to West Berlin and was interviewed over the West German radio network. Herr Frost said that the East German airline was running at a very heavy loss, and quoted some startling figures to prove it.

He said that one hour's flying by the Il-14 used by DLH cost 2,300DM (£209), while receipts from such a flight when fully loaded amount to only 740DM (£67). With regard to the three Il-18s recently acquired by DLH the corresponding figures were 18,000DM (£1,636) costs (presumably total costs) against receipts of 6,000DM (£545). (This Il-18 cost compares with the estimated direct operating cost per hour of £248-£293 for the Canadair CL-44D4 operating a 1,000 mile domestic stage.) Herr Frost also revealed that DLH is very short of electronic equipment both for airborne and ground services; this is not being delivered by Russia and the East German DLH is not allowed to buy it in the West.

## NO APPLES FOR FALCON

THE usually heavy proceedings of the ATLB were subject to a little light relief recently when Falcon Airways applied for a service as a "substitute" for one already approved, under licence No. B784. It transpired that Falcon's managing director had not completely understood the regulations and had been under the impression that he could "exchange some oranges he no longer wanted for an apple." The "oranges" were a restricted series of Hermes or Viking flights from Gatwick to Strasbourg or Dijon between May and October of this year, while the "apple" was an IT service from Gatwick to Innsbruck in conjunction with Tyrolean Travel. Cunard Eagle objected on the grounds of diversion from their London - Innsbruck services, but Mr Beezley, for Falcon, said that his company had ascertained on March 3 that there was virtually no space available on these services. To this Mr Scott of Cunard Eagle replied that all the traffic could be catered for on his company's scheduled Innsbruck services, and quoted a seat capacity of 14,000 and estimated sales at 8,000.

This "oranges and apples" hearing was rather unusual in that neither the applicant nor the objector had come provided with detailed figures to support their contentions regarding traffic diversion. This is a point that independents will have to watch, since there is hardly a case that is not likely to involve the issue of diversion to at least some degree.

Mr Cox, of Tyrolean Travel, produced a letter from Eagle to another agent asking for seats. Mr Scott said he had not been aware of the letter's existence. It seemed rather curious that the applicant was allowed to introduce in evidence a letter addressed to a third party not mentioned in the application; copies of this letter, being a relevant document, should have been made available to the Board and to the objector.

## SWISS BLISS

LIKE its Scandinavian partner, Swissair last year had to face the aggravation of DC-8 delivery delays. At the recent annual general meeting to consider the airline's annual report for 1960, the president declared that these delays had lost Swissair some Fr7m in revenue last year, equivalent to a reduction in net profit of some Fr4m. Unlike SAS, however, Swissair emerged in good financial shape, the accounts showing a net profit of Fr5m (Fr7.5m in 1959), after having allowed an additional Fr1m depreciation on the obsolescent DC-7Cs.

Superficially it is difficult to see why Swissair succeeded where SAS failed. One factor was probably their ability to keep staff numbers down to only 7,332 employees at the year-end. Another was Swissair's success in maintaining a high load factor (59 per cent as against 61 per cent in 1959)—a success which must be attributed to Swissair's most impressive combination of effective advertising with superb in-flight passenger service. The effect of this customer appeal was most noticeable on the highly competitive North Atlantic, where Swissair's traffic was as much as a third up on 1959. As a result, the North Atlantic replaced Europe as Swissair's principal theatre of operations. Because of high revenue rates and high load factors, intra-European services continued to provide the bulk (40 per cent) of traffic revenue, with the North Atlantic providing a further 32 per cent. Of the balance, the Middle-East and Far East contributed 11 and 10 per cent respectively, while the South Atlantic services made up the remaining 7 per cent. This degree of concentration—approximately three-quarters of Swissair's business being obtained in Europe and on the North Atlantic—is a further point of distinction from the widely scattered operation of SAS and is perhaps the key to its happier experience during the difficult transition period from piston to jet.

As with SAS, an excessive number of different aircraft types posed Swissair a major problem in 1960, particularly as regards engineering and crewing. The intention is to rationalize on DC-8s for long-haul, on Convair 660s for medium-haul, and on Caravelles and Metropolitans for short-haul. A few DC-3s have to be retained (Berne, for instance, cannot accommodate larger aircraft), and a couple of DC-6As will be kept for all-freight operations. This means that the DC-7Cs and the DC-6Bs will have to find other stables. Another problem shared with SAS was that of financing the expensive acquisition of jet equipment. With no deficits to eat into reserves, Swissair has managed to meet its commitments to date, and a recent share issue will cover the outstanding commitments on the Convair 660 fleet and on the new base at Kloten. With the prospect of reduced unit costs in the offing, and a fleet as competitive as any in the coming pre-supersonic era, Swissair can afford to look forward with confidence towards the mid-sixties.

*A new shot of Aeroflot's little An-14 Pchelka (Bee), powered by two 260 b.h.p. Ivchenko AI-14R piston engines. Broadly comparable with the Short Skyvan, and having rear-loading doors, the An-14 is believed to be in service in some numbers*

*The Breguet 942 mock-up displays how accommodation for 45 passengers is provided in facing seat rows, an unusual feature being that these seats are metal-backed and can be folded downwards to allow freight to be carried on them. Further freight space is provided forward, and carry-on luggage space aft. The 942 is the pressurized version of the 941*

## AIR COMMERCE . . .

### BOAC AND BEA TRAFFIC, 1960-61

TOWARDS the end of every summer BOAC and BEA present to the Minister and to Parliament their annual reports for the financial year ending March 31. These reports are fuller and more detailed than any other in the world, particularly in respect of the financial information presented. For the time being we must await the opportunity to examine the two corporations' finances—though it is known that BOAC expects to show a profit of at least £1¼m, while BEA expects to show a reduced loss of about £1¾m. Meanwhile, at about this time every year, the Ministry of Aviation publishes traffic figures for the year ending March 31, and these provide the opportunity for an advance look at the traffic chapters of the two corporations' forthcoming reports.

**BOAC** The essence of the story, as expected, is big increases in capacity, especially on western routes, with a shortfall in traffic on western routes. Looking at BOAC's 1960-61 year as a whole, capacity ton-miles were increased by nearly 30 per cent to almost 570m. Load short ton-miles went up by 25 per cent to nearly 316m, a remarkable increase in business by absolute standards, though not relative to the increase in capacity. Load factor declined by two percentage points to 55.5.

The reason for the overall shortfall is to be found in the figures for the western routes, which show that though capacity was increased by no less than 46 per cent, traffic increased by barely more than 35 per cent. For the first time BOAC offered more ton-miles than it sold across the Atlantic, load factor being less than 50 per cent.

In terms of passenger load factor, the picture was not quite so bleak, a load factor of 57.4 per cent being achieved. By way of contrast, load factor on eastern routes was increased as a result of traffic increasing by 16.7 per cent for an increase in capacity of 14.4 per cent. Actual load factor was 63.7 per cent.

The total number of passengers carried on all services by BOAC was 790,718, of which some 60 per cent were carried across the Atlantic. For the first time in any BOAC financial year more than half the corporation's capacity, actually 55 per cent, was scheduled westwards.

Of the majority of the corporation's traffic load ton-miles, 51 per cent still comes from the other routes. The number of charter hours flown by BOAC aircraft broke all records, more than 36,000, an increase of 141 per cent on the previous year—evidence no doubt of the booming North Atlantic charter business. Total hours flown by BOAC on scheduled services in the year under review was 158,500.

**BEA** Overall load factor in 1960-61 was precisely 65 per cent. Though this was a fall of 2.4 percentage points it may be said that load factor in the previous year suggested that demand was not being entirely met.

Total scheduled traffic on all BEA services rose by nearly 19 per cent, much the same as the growth in the previous year. The proudest figure of all is the number of passengers carried, which reached almost 4m, to make BEA the biggest passenger carrier of any airline outside the United States, and the fifth biggest passenger carrier in the world. BEA flew a total of 191,501hr on scheduled services and flew nearly 130,000 stage flights compared with BOAC's 42,000.

**The Corporations, 1960-61**
**(Traffic on scheduled services)**

| | BOAC | Increase on 1959-60 | BEA | Increase on 1959-60 |
|---|---|---|---|---|
| Capacity ton-miles | 569,387,000 | 29.9% | 232,636,000 | 23.2% |
| Load ton-miles | 315,849,000 | 25.0% | 151,133,000 | 18.7% |
| Overall load factor | 55.5% | 57.6% | 65% | 67.4%* |
| Freight ton-miles | 44,708,000 | 10.9% | 18,625,000 | 12.3% |
| Mail ton-miles | 29,495,000 | 22.4% | 4,215,000 | 5.3% |
| Seat-mile × 1,000 | 4,141,801 | 33.5% | 2,088,871 | 25.6% |
| Passenger miles × 1,000 | 2,470,243 | 29.7% | 1,393,364 | 26.8% |
| Passengers | 790,718 | 32.3% | 3,990,957 | 21.3% |
| Freight (tons) | 12,584 | 22.4% | 47,278 | 15.9% |

* Actual load factor. Source: Ministry of Aviation.

## BREVITIES

Continental airlines has ordered four Boeing 720Bs for its new California - Arizona - Texas routes. Delivery will be in 1962.

BOAC 707s are now operating the Monarch service twice-daily between London and New York.

BEA has introduced Vanguard V.953s on its route to Palermo, the first direct service between London and Sicily.

Finnair has ordered a fourth Caravelle for delivery next year. The airline already has three Caravelles.

TWA intends to "out-lavish anything offered before in airline luxury service" with its *Royal Ambassador* transatlantic 707 service starting on June 16.

According to *Interavia*, the US international flag carriers and FAA representatives will meet in New York on June 21 to discuss the US policy to be put forward at the ICAO Paris meeting on September 18.

BOAC has opened a new component test house at London Airport for the after-overhaul testing of air conditioning, pressurization and electrical system components. The corporation has also installed its own closed-circuit TV at Idlewild to provide pilots with weather briefing.

Mr Alan L. Dean has been appointed Deputy Administrator for Administration of the FAA. Mr Najeeb Halaby is Administrator. The FAA has signed a contract with Flight Safety Foundation to develop a pilot reporting programme to obtain data on incidents in which mid-air collisions have barely been avoided.

There were only three casualties among 109 passengers—all cases of slight injury—when an Air France Boeing 707 *en route* from Paris to Lima burst a tyre while landing at Lisbon last Thursday night and caught fire. Most of the baggage, cargo and mail was salvaged, but some hundreds of chickens on their way to a farm in Central America were killed.

Portuguese divers have located the wreckage of the Viasa DC-8 which crashed soon after taking off from Lisbon, and salvage operations have been started. The Dutch Aeronautical Inquiry Board have dismissed reports that a bomb caused the loss of the KLM Super Constellation over the Atlantic in August, 1958. The Board concluded that the cause "cannot be ascertained with certainty."

According to the *Daily Express*, Mr Thorneycroft has refused to help British United in its efforts to lease land at Gatwick from BEA.

Two secondhand Viscounts purchased from the manufacturers are to be added to the ten already owned by Indian Airlines Corporation.

Boeing announces the formation of a Swiss affiliate, Boeing-Vertol Europa SA, to further Boeing plans for sale and service of Model 107 helicopters in Europe, and perhaps eventually to manufacture the 107.

Two Grumman Gulfstreams are being modified for the FAA for navaid calibration and testing of airborne equipment. They will be used by the FAA's Research and Development Center at Atlantic City.

Qantas' request for a stop at Tahiti on its Australia-US services would, if granted, result in an annual loss of more than $500,000 (£178,000) to South Pacific Air Lines, according to CAB examiner Joseph Fitzmaurice, who recommended rejection of the Qantas application.

Eastern's L.1049C Super Constellation "commuter" services from New York to Boston and Washington have been supplemented by similar Electra services between New York and Richmond (Va), Greensboro/High Point (NC), Birmingham (Alabama) and Louisville (Kentucky). Eastern is the first US domestic trunk airline to operate such services.

Cambrian Airways announces that its traffic for the first five months of this year points to another successful year. Overall traffic carried up to May 31, 1960, numbered 7,555 passengers, and 14,724 in the same period this year, an increase of 95 per cent. Channel Islands traffic shows a 20 per cent increase over the same period of 1960, Paris traffic an 86 per cent increase and Dinard traffic a 98 per cent increase.

Last Sunday, June 18, Southampton Eastleigh received its first scheduled service since the change of ownership. Jersey Airlines flew in at 1115 and will initially be operating a three-times-a-week service on the route Southampton - Guernsey - Jersey. Customs are now available on request, and other operators such as Cambrian, who have a licence to operate services from Eastleigh to the Continent, are expected to start or resume services. Silver City will begin charter flights from Eastleigh on August 1, and this may be a prelude to regular services.

# SHORT BROTHERS & HARLAND LIMITED

in their

## 'BELFAST' PROJECT OFFICE

require immediately the following staff for work on the civil and military development of the

## 'BELFAST' FREIGHTER

1. SENIOR PROJECT DESIGNER

**Duties:** Preparation of preliminary aerodynamic and structural design proposals with a minimum of direct supervision. To be directly responsible to the Assistant Chief Designer 'Belfast' for the day-to-day supervision of the Project Office and for liaison with other technical departments.

**Qualifications:**

(*a*) B.Sc.(Eng.)(Aero.), D.C.Ae. or equivalent.

(*b*) Minimum of five years' experience of performance estimation in a reputable company or establishment.

(*c*) Good all round knowledge of, and interest in, structural and system aspects of aircraft design.

2. PROJECT DESIGNERS

**Duties:** Preliminary design investigations chiefly of a performance nature.

**Qualifications:**

(*a*) H.N.C. or equivalent.

(*b*) Minimum of two years' experience in a specialist technical department, e.g. Aerodynamics or Structures.

The Company operates a Superannuation Scheme with which is associated Life Insurance.
Assistance is available with housing and with removal expenses to married candidates from Great Britain.
Suitable applicants will be interviewed by the Assistant Chief Designer 'Belfast' in London or in Belfast at the applicant's convenience.
Application in the first instance should be made to the:

**Staff Appointments Officer**
**P.O. Box 241**
**Belfast**
**Quoting: S.A. 709**



**Get the most from your holiday on the Continent**

# GO CONTINENTAL—BY CAR

**holiday motoring in Europe**

W. HUTTON. This new book explains how to prepare for a continental holiday, how to avoid congested routes, and gives unique information on roads, conditions of roads, hotels, and places to see and visit. All the main countries are visited and chapters cover mountaineering by car and winter sports by car. Including many clearly drawn maps and with 24 pages of plates this book will be of invaluable assistance to every motorist planning to visit the Continent this summer.

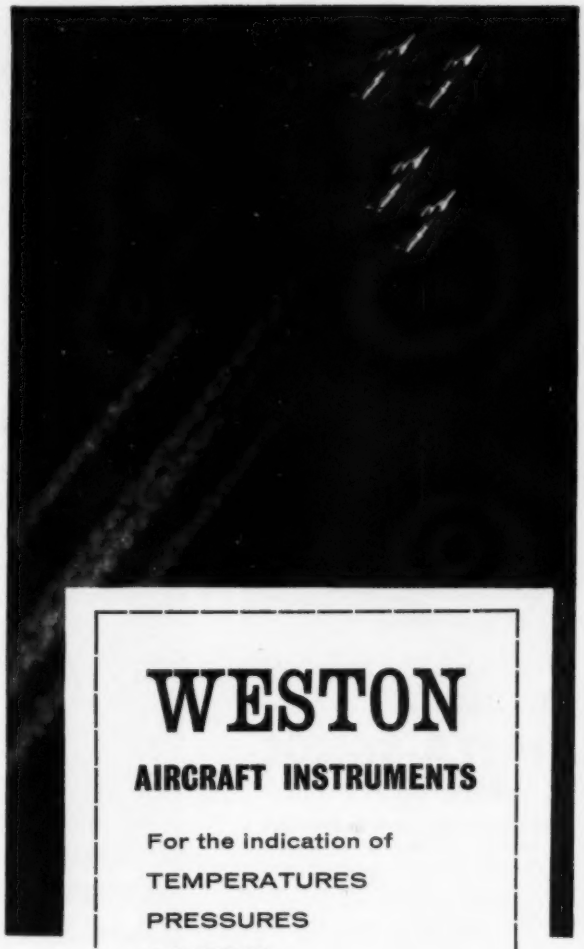
**168 pages · 24 clearly drawn maps**
**24 pp. of magnificent plates**

**17s 6d net. By post 18s 5d. From all booksellers**

**An AUTOCAR book**

Dorset House Stamford St London SE1





# WESTON

**AIRCRAFT INSTRUMENTS**

For the indication of

TEMPERATURES

PRESSURES

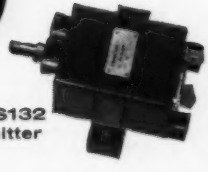
CONTROL SURFACE POSITIONS*

TURBINE SPEEDS

ELECTRICAL POWER

**ALSO: Ground Test Sets, Relays, Ice Warning Systems, Navigational Aid Indicators.**

*Model S216 Indicator



*Model S132 Transmitter

# SANGAMO WESTON LIMITED

**ENFIELD · MIDDLESEX**

*Tel: Enfield 3434 (6 lines) and 1242 (6 lines) Grams: Sanwest, Enfield*
*Scottish Factory: Port Glasgow, Renfrewshire, Port Glasgow 41151*
*Branches:* London, CHAncery 4971 · Glasgow, Central 6208 Manchester, Central 7904 · Newcastle 26867 · Leeds 30867 Liverpool, Central 0230 · Wolverhampton 21912 · Birmingham, Midland 9118 · Nottingham, 42403 · Bristol, 21781 · Southampton, 23328

SANGAMO WESTON

SW/110

Executive Air Charter Service

## THE OXFORD AVIATION CO. LTD.

OXFORD AIRPORT
*Kidlington 3061*

BIRMINGHAM AIRPORT
*Sheldon 2441, Ex. 99*

Aerocab, an executive air charter service for British industry, flying modern single- and twin-engined Piper aircraft

A member of the group of companies

## MILLER AVIATION LIMITED

ADASTRAL HOUSE · NUTFIELD · REDHILL · SURREY
Tel: REDHILL 5050 (10 lines) Cables-Telex-21433-SASCO-REDHILL

. . it's Continental
. . it's elegant

## the new META-SOKOL

*light executive aircraft*

- ★ RETRACTABLE UNDERCARRIAGE
- ★ V.P. PROPELLER
- ★ Fuel injection for economy and safety
- ★ Cruises at 127 m.p.h. with a consumption of only 4½ g.p.h. (28 m.p.g.)
- ★ Comfortable 4 seat cabin with exceptional all round view
- ★ Comprehensive Standard Equipment
- ★ Full spares backing

*Enquiries welcomed for the Meta-Sokol and the Light-Twin Aero 145*

SOLE U.K. AGENTS
**PETER S. CLIFFORD & Co. Ltd.**
**Oxford Airport, Kidlington**
**Phone Kidlington 3355**
**Evening and W/Ends Bletchington 392**
in conjunction with G/C Edward Mole, U.K. Distributor.
World wide distributors OMNIPOL, PRAGUE

## Keegan Aviation LTD

What we advertise we own

We have a complete range of British and American business aircraft in stock for immediate delivery . . . . . .

Also available a permanent lease fleet comprising D.C.4's, Viscounts, Bristol 170's, Vikings and D.C.3's.

Send for full illustrated details.

## Keegan Aviation LTD

Panshanger Aerodrome, Hertford
Telephone: ESSENDON 491 2 3
Cables: PLANESALES HERTFORD
Telex: 1943

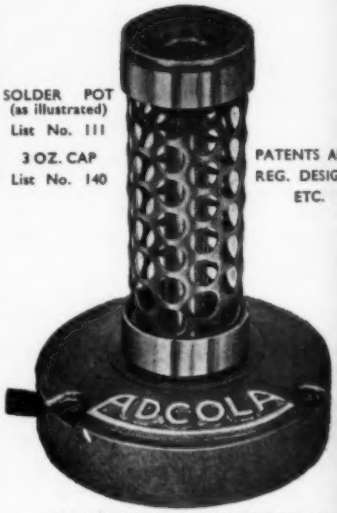
## ADCOLA

(Regd. Trade Mark)

SOLDERING EQUIPMENT

AS IN THE CASE OF THE RENOWNED ADCOLA SOLDERING INSTRUMENT ELEMENTS, THE SOLDER POT IS MANUFACTURED FOR ALL VOLTAGES

SOLDER POT (as illustrated) List No. 111
3 OZ. CAP List No. 140




PATENTS AND REG. DESIGNS ETC.

SOLE PROPRIETORS and MANUFACTURERS
Head Office, Sales Service
**ADCOLA PRODUCTS LIMITED**
**GAUDEN ROAD, LONDON, S.W.4**
Tel: MACAULAY 3101 and MACAULAY 4272

BUSINESS AEROPLANES

## Beechcraft

*Available from* **Shorts**

There is a Beechcraft for every business requirement. For demonstration flights or details of the 1961 range of these distinguished high performance aircraft, please write to the British Isles distributors:

SHORT BROTHERS & HARLAND LTD
Light Aircraft Division
Queen's Island, Belfast, N. Ireland
or The Aerodrome, Rochester, Kent

LEAVE COMPETITORS BEHIND WITH A CESSNA

Write for details to
W.H. & J. ROGERS (ENGINEERS) LTD.
Great Barford, Bedford

## Cessna

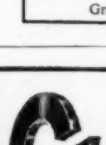
APPOINTED DEALERS

**The North & West Midlands:** Westair Limited, Squires Gate Airport, Blackpool, Lancs.
**East Anglia & East Midlands:** W. H. & J. Rogers (Engineers) Ltd., Gt. Barford, Bedford.
**West:** Steels (Aviation) Limited, Clifton, Bristol.
**Scotland:** Airwork Services Limited, Perth Aerodrome, Perth, Scotland.

SOLE DISTRIBUTORS IN GREAT BRITAIN ARE
**AIRWORK SERVICES**
PANSHANGER AERODROME · HERTFORD
TELEPHONE: ESSENDON 315

## I FLY PIPER

*Sole Distributors in the U.K.*
**VIGORS AVIATION LTD. OXFORD AIRPORT. KIDLINGTON 3444**



Perfect Precision Aircraft Spring Washers to B.S. Specification 2 SP.47.

**CROSS MFG. (1938) LTD.**
Combe Down, Bath, Somerset
*Tel:* Combe Down 2355/8
*Grams:* Circle, Bath

# CLASSIFIED ADVERTISEMENTS

**Advertisement Rates.** 1/2 per word, minimum 14/-. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Public Appointments, Tenders 1/4 per word, minimum 16/-. Each Paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

**Postal Orders** and cheques sent in payment for advertisements should be made payable to "Flight," and crossed & Co.

**Trade Advertisers** who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

**Box Numbers.** For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000 c/o Flight," Dorset House, Stamford Street, London, S.E.1.

**The Publishers** retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

**FLIGHT**

**Aircraft, Spacecraft, Missiles**

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

## AIRCRAFT FOR SALE

**R. K. DUNDAS LTD.**

**OFFER THE FOLLOWING AIRCRAFT FROM THEIR SELECTION OF EXECUTIVE AND CLUB AIRCRAFT:**

CESSNA 310. 1956 Model T.T. 730. Both engines 10 s.m.o.h. L2 Autopilot, STR 12D, Marconi AD 722, ARC 15 Omni, LVTR 36, Glide Slope Receiver and Marker Beacon. Available with 12 months' C. of A. £16,000.

COMANCHE 1960 AUTOFLITE "250." T.T. 130, All Super Custom extras. Narco Mk. II, V.H.F., V.O.R., ILS Localiser, Marker Beacon, ADF.12E. As new, with new C. of A., £8,850.

DOVE. Low time engines and propellers. Luxurious V.I.P. interior. STR 12D, STR9X, SR14/15 ILS, ADF 7092. New C. of A. £14,000.

TRIPACER, 1952. Super Custom. Engine 530 s.m.o.h. New fabric and paint 1959. New interior 1961. Narco VHT-3. V.H.F., V.O.R., ILS, Full panel, night flying and dual control, £2,680.

AUSTER ALPHA. Gipsy Major I. 750 s.m.o.h. MR.60 VHF, battery, generator, dual control, Directional Gyro, Glider Hook. 4 seats. £1,250.

AUSTER AUTOCRAT. Cirrus Minor. 45 s.m.o.h. 4ch. V.H.F. Full panel, dual control, long range tank. 3 seats. New C. of A. £1,250.

Also several near-new Aztec and Apaches. Full details on request.

R. K. DUNDAS LTD., Dundas House, 59 St. James's Street, London, S.W.1. Tel.: HYDe Park 3717. Cables: Dunduk, London. [0559

---

D.H. CHIPMUNK Mk. 22, full dual, 10 channel radio, night flying, electric starter, nil hour engine, full aerobatic C. of A., etc., etc., £3,000.

A. J. WHITTEMORE (AERADIO) LTD., Biggin Hill, Kent, Biggin Hill 2211. [0501

BEECHCRAFT BONANZAS. Single Bonanza E-35, total airframe 1650 hours.

TWIN Bonanza B-50, total airframe 2525 hours.

AVAILABLE IMMEDIATELY in Europe. Apply for details to Astraeus Limited, 167 Victoria Street, London, S.W.1. Tel.: VICtoria 1403. Cable Arreffay, London. [0015

A HANDLEY PAGE MARATHON, only 1,000 hours since new. C. of A. expires July 1961. Fully airline equipped including radio. 20 seats, V.I.P. interior. Immediate delivery. £6,500.

DOVE USERS, propeller, C.S.U.'s, starters, Gipsy Queen 70/4's all nil hours, overhauled by makers.

MILES GEMINI, Mark 1A, full dual control, radio, many extras. Derby Aviation Limited, Derby Airport. Tel. Etwall 521. [2356

GYROCOPTER, fully modified McCulloch with ducts, fuel system and propeller. Installed in airframe complete, less rotor blades. Also road trailer, etc. £400. Box No. 7237. [2387

GEMINI GIPSY MAJOR, 10s STR9X 44 channels ADF, excellent condition, would exchange for Auster or similar, cash adjustment. Widney Cottage, Knowle, Warwickshire. [2385

JODEL MUSKETEER, 4 seater, 200lb baggage or 5 seater with adequate luggage. 6 hours range at 140 m.p.h. Will operate with full load from fields of 250 yards. With luxurious furnishing, gyro compass and horizon at only £4,816 fly away Redhill Aerodrome. Try it yourself—contact Rollason Aircraft and Engines Ltd., Croydon Airport. Tel.: CROydon 5151/2. [0138/1

TIGER MOTH. C. of A. expired June 1, 1961. £450.

TIGER MOTH. Part C. of A.'d but complete. £300.

GEMINI LA CIRRUS MINOR 2 ENGINES, Radio all in excellent condition. Offers invited.

LUTON FLYING CLUB LTD., The Airport, Luton. Luton 4426. [2340

---

# 30 YEARS EUROPE'S LEADING AIRCRAFT TRADERS EXPERIENCE AND SERVICE

### LIGHT AIRCRAFT DIVISION

One of the best equipped Piper Tri-Pacers in the country, with only 100 hours since manufacture last year, is offered for immediate delivery with current C. of A. or with Certificate renewed for a further 12 months or 3 years.

In addition to all normal equipment this aircraft carries Autoflite, Collins VHF 17L8A/51X3 and 51X3 VOR. Inspection any time.

### TRANSPORT AIRCRAFT DIVISION

A unique Super DC.3 fitted with P & W 1830-94 engines which offer a true air speed of 175 kts.

The aircraft has the full Transair wheelwell modifications and has flown only some 4,500 hours since new. Interior is an executive version embodying 12 seats and toilet.

Radio includes VHF, HF, ADF, ILS, Intercom. and Duplicated Decca.

Spares available with the aircraft include one spare nil hour engine, one propeller, two generators, two U/C wheels complete, and many engine and airframe parts, and the aeroplane is available with current C. of A. for immediate service.

### EXECUTIVE AIRCRAFT DIVISION

An unusually good Aero Commander 680 is offered for quick delivery. It is a 1958 aircraft with only 750 hours total time.

Special equipment includes full airframe and propeller de-icing and Lear L2 Autopilot.

Radio station consists of:

2 ADF ARC 21A
1 Sunair HF
1 17L8 Transmitter
2 ARC 15D Receivers
1 MB 3 Marker Receiver
1 Wilcox 700B Glide Slope Receiver
1 ARC 210 VHF T/R (360 channel)
Gyrosyn Compass.

*NEW OR USED AIRCRAFT SUPPLIED* — *CREDIT TERMS ARRANGED* — *PART EXCHANGE WITH OTHER AIRCRAFT OR CARS*

**W.S. SHACKLETON AVIATION LIMITED**

HYDE PARK 2448/9 175 PICCADILLY, LONDON, W.1

---

## AIRCRAFT ACCESSORIES & ENGINES

AIRTRADE LTD., for Aircraft and Aero Engine spares. Components and Instruments. A.R.B., Croydon Airport, Surrey. Tel.: CRO 0643. [0232

H. T. NEWTON AND CO. and NEWTONAIR LIMITED, Gatwick Airport, for all your aircraft electrical and electronic equipment. A.I.D. and A.R.B. [0299

ROLLASON'S for Tiger Moth spares, Gipsy engine overhauls and spares; and now increased facilities at Biggin Hill for your C. of A. overhaul. All light aircraft types acceptable. Croydon 5151. [0133

AERONAUTICAL & MARINE SUPPLIES LTD. for all aircraft and engines spares for Dakota, Viking and Dove aircraft. Aeronautical & Marine Supplies Ltd., Southend Airport, Essex. Tel.: Rochford 56435/6. [0163

PLUGS and Sockets. More than 1,000,000 in stock covering over 50 different ranges. British and American. Stock list on application to Sasco, Nutfield, Redhill, Surrey. Tel.: Redhill 5050. [0052

PHILLIPS & WHITE LIMITED. The leading stockists in the U.K. for Instruments, Navigational Equipment. Electrical Components and parts, and Engine accessories. Spares for de Havilland Gipsy Major and Queen series and Armstrong Siddeley Cheetah IX, X and XV engines. 61 Queen's Gardens, London, W.2. Tel.: Ambassador 8651, 2764. Cables: "Gurair, London." [0466

## AIRCRAFT ACCESSORIES & ENGINES

FAIRCHILD Argus engines and airframe complete. Travelair Ltd., 115 Oxford Street, W.1. (Tel.: GER. 3382. [0135

PARACHUTES, 24ft nylon back-type, £10 each, ditto seat-type, £8 each, also American 28ft seat-type, £15 each. Details from H. H. Bradford Ltd., Ramsey, Harwich, Essex. [2271

VENDAIR Aircraft Service and Sales, for aircraft spares and equipment. Vendair, Biggin Hill Aerodrome, Kent. Telephone: Biggin Hill 2251/2. [0566

---

**DH DOVE ENGINES**
**PROPELLERS**
**ACCESSORIES & PARTS**

Gipsy Queen 70 Mk 2
Gipsy Queen 70-3
Gipsy Queen II
Propellers PD 143/312/1
Nose gear 4UN 1

also various accessories, instruments, engine parts and airframe parts available from stock in "as is" or overhauled, certified condition.

Please make an offer or ask for prices.

**SCANDINAVIAN AIR TRADING CO, HANGAR A, COPENHAGEN AIRPORT, DENMARK. TELF. 509494** [2377

## AIRCRAFT ACCESSORIES & ENGINES WANTED

DOVE PORT WING complete, wanted, must be in repairable condition. Also 2 Gipsy Queen 70 Mark II Engines and Power Plants and 2 De-Iced Propellers. Box No. 7244. [2395

## AIRCRAFT FOR HIRE

CESSNA. Skyhawk and Skylark models available on contract hire. W. H. & J. Rogers (Aviation) Ltd., Great Barford, Bedford. [2357

## AIR PHOTOGRAPHY

MORSE Film Developing Units and Film Driers. Continuous Film Printers, Argon and Mason Contact Printers; Water Supply Kits; Glazing Machines, F24 Spiral and Spool Developing Outfits; K17, K15, K49 and K24 Cameras. Mounts, Lenses, Magazines, Controls, Vacuum Pumps, Motors and Spares for above Cameras; 16mm and 35mm Cameras, Projectors and Spares. Also large quantity of Aerial Film (all sizes). A. W. Young, 47 Mildenhall Road, London, E.5. Tel.: AMHerst 6521. [0290

## AVIATION COMPUTERS

KAYS OF EALING. Stockists of Aristo, Jeppesen, Weems, Swissair, R.A.F. Mk. 4, Box Dalton. Computors, Scale Rules, Protractors, etc. Quotations, Mail Order, by return. Write for latest Stock List. 8-10 Bond Street, Ealing, W.5. EAL. 2813. [0244

## BALL BEARINGS

NEW Ball and Roller Bearings, over 4,000,000 in stock in more than 4,000 types. Britain's largest stocks. Stock list available. Claude Rye Ltd, 895-921 Fulham Road, London, S.W.6. RENown 6174 (Ext 24). [0420

## BINOCULARS

CANADIAN ex-Naval officer's (Bausch and Lomb pattern) 7 × 50 Prismatic eyepiece focusing (cost £60). Limited supply, new with case, £19 17s. 6d. A. W. Young, 47 Mildenhall Road, London, E.5. Tel.: AMHerst 6521. [0291

## CLOTHING, FOR SALE OR WANTED

R.A.F. officers' uniforms purchased, good selection of R.A.F. officers' kit for sale, new and reconditioned. Fisher's Service Outfitters, 86-88 Wellington Street, Woolwich. Tel.: Woolwich 1055. [0567

**RUDNICK HELICOPTERS LTD.**

require for their permanent New Zealand agricultural operations Helicopter Pilots, minimum 500 helicopter hours, preferably on Bell, CPL; Helicopter Engineers, licensed for Bell helicopters. Apply:

RUDNICK HELICOPTERS LTD.,
P.O. Box 544, Wanganui, New Zealand

**SPECIAL TOOLS**

| | | |
|---|---|---|
| H.S.P. | ... | Douglas |
| P.W. | ... | Wright |
| Bosch | ... | Scintilla |
| D.H. | ... | Bristol |

**Large stocks available for immediate delivery.**

**STARAVIA LTD.**
**Redfields Works, Church Crookham,**
**Nr. Aldershot, Hants.**
Tel.: FLEET 1383

## CLUBS

30/- PER HOUR for dual or solo flying on Tiger Moth aircraft. Annual subscriptions required. Call or write now. Uxbridge Aero Club, Biggin Hill. [0235

MAITLAND DREWERY FLYING CLUB. Instruction and Touring facilities. Modern American Aircraft. Biggin Hill 2277. [2388

## ELECTRICAL EQUIPMENT

ELECTRICAL Connectors. More than 1,000,000 in stock, covering over 50 different ranges. British and American. Stock list on application to Sasco, Nutfield, Redhill, Surrey. Tel.: Redhill 5050. [0054

## ENGINE OVERHAULS

ENGINE overhauls. Hants & Sussex Aviation Ltd. offer Britain's most comprehensive overhaul service, including magneto and component overhaul with spares supply. All D.H. range up to Queen 30 Mk 2 for Heron. Armstrong Siddeley, Blackburn Cirrus, Lycoming and United Kingdom distributors of Continental motors. Huge exchange pool most types engines. Specialists in export work. Address: The Airport, Portsmouth, Hants. Tel.: 63051. [0711

**FAIREY AVIATION LIMITED**
*(A Division of Westland Aircraft Limited)*

**LICENSED INSPECTOR**

required to fill staff position at White Waltham Aerodrome. Must hold 'A' and/or 'C' licences covering P & W 1830 Dakota or Queen 70 Dove aircraft. Good salary with bonus. Non-contributory Pension and Life Assurance scheme. Transport available from Maidenhead, Reading and Slough.

*Please apply to the Assistant Chief Inspector (Civil),*

**Fairey Aviation Limited,**
**White Waltham Aerodrome,**
**Nr. Maidenhead, Berks.**
**Littlewick Green 251**

## INSURANCE

ENDOWMENT Assurance, House Purchase, and Retirement Provision, including full flying cover without extra premiums for Pilots and Aircrew of B.E.A., B.K.S., B.O.A.C., British United Airways, Cunard-Eagle, Silver City and members of B.A.L.P.A. City Assurance Consultants Ltd., 46 Cannon Street, London, E.C.4. CITy 2651. [2142

## PACKING AND SHIPPING

R. AND J. PARK LTD., 143/9 Fenchurch Street, E.C. Tel.: Mansion House, 3038. Official packers and shippers to the aircraft industry. [0012

## PUBLIC APPOINTMENTS

**RESEARCH FELLOWSHIPS**
**in**
**GOVERNMENT SCIENTIFIC ESTABLISHMENTS**
**Tenable for three years**

Value £1,325 to £1,640 p.a. (Senior) and £910 to £1,220 p.a. (Junior). A very wide range of topics in Physics, Mathematics, Chemistry, Engineering, Biology and other fields. Qualifications: Normally first or second class honours degree; evidence of high standard of ability in research; and at least 2 years' post-graduate research experience (3 years for Senior Fellowships). Those completing these periods of experience in 1961 may apply. F.S.S.U. Write: Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting S/5244/61. [2382

## RADIO AND RADAR

AFTER Sales Services. This is important with modern complex equipment. Make sure you order your new equipment through A. J. Whittemore (Aeradio) Ltd., Biggin Hill, Kent. Biggin Hill. 2211. [0302

## SERVICES OFFERED

REPAIRS and C. of A. overhaul for all types of aircraft. Brooklands Aviation Ltd., Civil Repair Services, Sywell Aerodrome, Northampton. Tel.: Moulton 3251. [0307

## SITUATIONS VACANT

PILOT INSTRUCTORS required for service in Middle East. Two year contracts with free accommodation, free passages and medical facilities provided. Minimum requirement CPL, endorsed Austers, and/or Doves, with instrument ratings. Preference will be given to pilots with previous service instructional experience on Jet Provosts, Meteors or Vampires. Applications in writing to: Operations Manager, Bristow Helicopters (Eastern) Limited, Redhill Aerodrome, Surrey. [2378

SKYWAYS COACH AIR LTD have vacancies on their Dakota Fleet at Lympne Airport for Electricians and Instrument Mechanics holding current "X" licences. N.J.C. rates of pay, sick payment, paid holidays and contributory Superannuation Scheme. The fleet converts to AVRO 748s in the coming year. Written applications to the Personnel Officer, 7 Berkeley Street, W.1. [2381

# STRESS ENGINEERS
## required

for interesting work in a newly formed office. Experience in aircraft undercarriage and hydraulics would be an advantage. Attractive salary and conditions, including annual profit-sharing scheme.

Applications, which will be treated in strictest confidence, should give full details of age, qualifications and experience and be submitted to the

Personnel Manager,

**LOCKHEED PRECISION PRODUCTS LTD.**
**SHAW ROAD, SPEKE, LIVERPOOL 24**

## PRESSED STEEL COMPANY LIMITED

### AIR SERVICES DIVISION

The Air Services Division is responsible for the operation of Oxford Airport and whilst servicing the Company, functions as a normal commercial undertaking.

The Division invites applications for the following appointment

### Operations and Air Traffic Control Officer

This Officer will be responsible to the Divisional General Manager for Operations and the Air Traffic Control services of the airport, and duties will include the rostering of aircraft and crews for the Company's fleet of executive aircraft.

It is expected that the successful candidate will be a qualified Air Traffic Control Officer and experience in a similar capacity would represent an attractive attainment. Conditions of employment accord with best industrial practice and a commensurate salary will be paid.

*Applications may be made to:*

***Captain John W. Gillespie, General Manager,***
***Air Services Division, Pressed Steel Company Limited,***
***Oxford Airport, Kidlington, Oxford***

## BRITISH UNITED AIRWAYS

require

**ENGINE INSPECTOR**
Qualifications:- Valid "C" Licence with Dart endorsement.

**LINE CHARGEHANDS**
Qualifications:- Viscount "A" and "C" Licences. Consideration will be given to "A" and "C" Licence applicants with a valid endorsement in one category, Dart or Viscount.

**ELECTRICAL INSPECTORS**
Qualifications:- Current "X" Licence valid in categories 9.1, 9.2 and 9.3.

*apply* Personnel Manager, British United Airways, London (Gatwick) Airport, Horley, Surrey

## BEA

### RADIO MAINTENANCE ENGINEER

A man, preferably with a current ARME's licence, category A (R) with radar rating, required at Belfast Airport to work on a rotating three-shift cycle covering all aircraft radio servicing and repairs. An unlicensed man with several years' aircraft radio servicing experience and the ability to obtain a licence within a reasonable period will be considered. Salary (licensed) £16.19.6-£19.19.6 plus 33/6 special bonus; (unlicensed) 6/3 ph per 42 hour week. Appointment will be subject to the provision of the N. Ireland Safeguarding of Employment Act 1947. Detailed applications to

**PERSONNEL ASSISTANT, BEA,**
**Commonwealth House, Castle Street, Belfast, N. Ireland.**

## MAINTENANCE SCHEDULE ENGINEER

required by

**DAN-AIR ENGINEERING LTD**

*Apply to:—*

**Chief Inspector**
**LASHAM AIRFIELD**
**Nr. Alton, Hants.**
Tel: HERRIARD 282

***THIS IS A SENIOR POST***

## MINISTRY OF AVIATION

### Air Traffic Control Officers

Posts for men or women at least 23 and under 35 on 1/7/61. Candidates must have had recent aircrew experience, preferably as pilot or navigator in civil air transport or H.M. Forces; but exceptionally, extensive experience in A.T.C.O. duties may be accepted. They should normally also have G.C.E. with five passes, or an equivalent academic qualification. Starting salary (London) from £872 to £1,251. Maximum £1,599. Appointment initially unestablished, but prospects of establishment and promotion. Apply:

**MINISTRY OF AVIATION,**
**Est 5 (a) 1/R 758, The Adelphi,**
**John Adam Street, London, W.C.2**

## SITUATIONS VACANT

**AIR TRAFFIC CONTROL OFFICERS**
**Hong Kong**

*Qualifications:* Candidates should have passed G.C.E., School Certificate, or equivalent examination, and have had a minimum of 7 years' experience in aviation, as an Air Traffic Control Officer, Radar Controller or air-crew member, of which 3 years should have been as an Air Traffic Control Officer, Talk-down Controller or Radar Traffic Director *subsequent* to passing an approved course in Air Traffic Control. Experience in Area Control desirable. Preference given to applicants with experience as a Radar Traffic Director or Talk-down Controller.

*Age:* 25-35.

*Duties:* Air Traffic Control duties at Hong Kong Airport.

*Terms of Appointment:* On probation (2 years) to the permanent and pensionable establishment with emoluments in the scale £1,350 by £75 to £1,875; £2,055 by £90 to £2,505; £2,685 by £90 to £2,865 per annum. Minimum entry point for expatriates £1,500 p.a.; incremental credit up to maximum of 5 increments allowed for approved A.T.C.O. experience in excess of 3 years. Free passages. Accommodation provided at low rental. Free medical attention. Generous leave. Low income tax. Apply to Director of Recruitment, Colonial Office, London, S.W.1. State full name, age, qualifications and experience. Quote G1/BCD/98/51/01. [2379

PILOT SALESMAN to sell modern executive American aircraft is required with not less than 1,000 hours together with a twin rating. Preference will be given to those applicants with a current instrument rating.

IN THE FIRST instance apply to the Manager, Airwork Services, Panshangar Aerodrome, Hertford. [2380

**ROYAL AERONAUTICAL SOCIETY**
**(Technical Department)**

IN recent years the demands upon the Society's Technical Department have increased most markedly. The activities, which may best be described in general terms as the synthesis of design and analytical procedures, have been required to increase in scope and volume and the field of application of the work has extended as the use of techniques originally developed for aeronautical purposes has extended into many technologies. This is a reflection of the important changes taking place in the organisation of there search-design-production process throughout the world; the application and correlation of the vast amount of information resulting from the present high level of research activity is exercising the thoughts of many organisations both National and International. Clearly there is an interesting future for any activity which assists this process and the Royal Aeronautical Society's contribution is becoming particularly important in view of the Society's experience and the pioneering role which it has played.

THE most recent request from official quarters for extension of the work of the Department concerns a study of aerodynamic data appropriate to the high subsonic and transonic flight regimes; over a long period the extension of this work to higher speed ranges may be anticipated. A new group within the Department is undertaking the work and there are vacancies for engineers of varying experience in this group. In particular, in addition to junior engineers who are engineering or science graduates with experience of high speed aerodynamics, the Society is most anxious to obtain the services of a senior engineer. Such an engineer should be a graduate, be completely familiar with the interpretation and application of aerodynamic data appropriate to high subsonic speeds and, preferably, have had a number of years experience connected with wind tunnel testing or flight test analysis. The salary for this senior post will be of the order of £2,000 per annum with additional non-contributory pension and life assurance benefits.

FURTHER details of the work of the Society's Technical Department and of the vacancies on its staff may be obtained from:

**The Head of the Technical Department**
**ROYAL AERONAUTICAL SOCIETY**
**4 Hamilton Place**
**LONDON, W.1.** [2383

£20 A WEEK plus bonus offered for ground engineer with licences A., B. & C. on Tiger Moth aircraft. Immediate vacancy. Box No. 7236. [2384

A. AND C. LICENSED ENGINEER, Groups 5-2 and 6-1, required by Airwork Services Ltd., R.A.F. Ouston, Newcastle upon Tyne. [2386

ENGINEER, licensed A and C Tiger Moth, wanted for permanent position. Write Farm Aviation Ltd., Wigmore Hall Farm, near Luton, Beds. [0352

AIR LINKS, Gatwick, require Pilots. Minimum qualifications Commercial with Instrument Rating, ARB Dakota technical. Permanent positions. Also Dakota A & C licensed Engineer. [2312

# TT Races

*Full, dramatic reports—*
*brilliantly illustrated*

**Here in The MOTOR CYCLE's TT Report Number is the full vivid story of the Senior Race—greatest epic of them all. Described by The MOTOR CYCLE's on-the-spot team of experts, with breathtaking action pictures. Plus full report of the Junior—more gripping pages and pictures. Here too are close-ups and personal comments of the winners. This is a drama-packed special issue. Don't miss it.**

**OUT TODAY 9d.**

★ *NEXT WEEK: TT REVIEW*

THE MOTOR CYCLE

**TT REPORT NUMBER**

**CUNARD EAGLE AIRWAYS LIMITED**

**LONDON AIRPORT, HOUNSLOW**
**MIDDLESEX**

require

**'X' LICENSED INSTRUMENT ENGINEERS AND INSPECTORS**
(Ref: M.4)

**EXPERIENCED DEPUTY CHIEF INSPECTOR**
must be conversant with inspection requirements associated with operation of large civil aircraft and hold Maintenance Engineer's Licence, including 'B' Licence. Only applicants possessing above qualifications will be considered
(Ref: M.35)

**RADIO MECHANICS**
for Aircraft Radio Maintenance
(Ref: M.3)
Salaries—
**£13 10 0 to £16 10 0 per week**

**AIRCRAFT INSTRUMENT MECHANICS**
(Ref: M.18)

**LICENSED AIRCRAFT ENGINEERS, INSPECTORS OR CHARGEHANDS**
experience with Britannia, Viscount and DC6 Aircraft is essential.
(Ref: M.12)
Salaries — Engineers and Inspectors
**£1,005 to £1,315 p.a.**
Salaries — Chargehands
**£13 10 0 to £16 10 0 per week**

**QUALITY CONTROL ENGINEERS**
lengthy and comprehensive knowledge required of maintenance, inspection & overhaul practices and A.R.B. requirements particularly in the operation of 4-engined piston and turbine aircraft. Should hold current A.M.E. Licence.

*All applications in writing, quoting appropriate reference, to The Personnel Officer*

**COMMONWEALTH OF AUSTRALIA**

**WEAPONS RESEARCH ESTABLISHMENT**

**STAFF FOR WOOMERA ROCKET RANGE**

*The Department of Supply invite applications for employment in the following vacancies at the Woomera Rocket Range, South Australia.*

**SENIOR EXPERIMENTAL OFFICER** (a number of positions).
**SALARY:** £2,135 to £2,330 (Australian Currency).
**DUTIES:** Direct the work of a section of the Range staff engaged on:
(*a*) The operation, calibration, maintenance and modification of all telemetry ground equipment.
(*b*) The operation, calibration, maintenance and modification of all timing, intercom and closed-loop TV systems. Provision and servicing of all electronic test equipment.
(*c*) The servicing and calibration of all range optical instrumentation. This includes a considerable amount of electronic timing and servo equipment.
**QUALIFICATIONS:** An appropriate degree or equivalent qualifications. Extensive experience in one or more of the fields quoted above.
**EXPERIMENTAL OFFICER, GRADE 3** (a number of positions).
**SALARY:** £1,730 to £1,950 (Australian Currency).
**DUTIES:** Supervise the work of staff engaged on:—
(*a*) The operation, servicing and modification of Radio Doppler and Missile Break-up systems.
(*b*) The operation, servicing and modification of wide bandwidth telemetry equipment at various places on the Range.
(*c*) The operation and servicing of digital data equipment used for transmitting the position of missiles and satellites.
(*d*) The provision and servicing of all electronic test equipment and closed-loop TV systems.
**QUALIFICATIONS:** An appropriate degree or equivalent qualifications. Several years experience relative to one or more of the fields quoted above.
**SENIOR TECHNICAL OFFICER, GRADE 1** (Two positions).
**SALARY:** £1,678 to £1,780 (Australian Currency).
**DUTIES:**
(*a*) Supervise staff engaged on the operation and servicing of telemetry ground equipment at various points on the Range.
(*b*) Operate and service equipment used for tracking and telemetry of manned satellites for the Mercury Project.
**QUALIFICATIONS:** Academic qualification and experience in one or both of the above fields to be stated.
**GENERAL CONDITIONS:**
**ALLOWANCES:** At Woomera an allowance of £A120 per annum is payable to a married man maintaining a family; £A70 per annum to single persons.
**HOUSING:** Married accommodation will be made available within a reasonable period.
**TRAVEL:** Cost of First Class travel to Australia for successful candidates and their families (wife and dependent children) will be borne by the Commonwealth in the case of all positions except those of Senior Technical Officer.
Successful applicants for Senior Technical Officer positions will receive assistance from the Commonwealth in arranging migration.
**CONTRACTS:** For certain of these positions, contract employment will be considered. Details may be had on application.
**APPLICATIONS:** Forms available from the Senior Representative (AV.110/5), Department of Supply, Australia House, Strand, London, W.C.2, with whom completed applications should be lodged as soon as possible.

# VACANCIES FOR PILOTS

AER LINGUS—IRISH INTERNATIONAL AIRLINES invite applications for vacancies as Pilots.

Applicants should be under 30 years of age and must hold the following qualifications:

Commercial Pilot's Licence

Instrument Rating

R/T Licence

Applications should be made on the Company's standard Application Form which may be obtained, together with details of salary and conditions, on POSTCARD request to the Personnel Department, Aer Lingus—Irish International Airlines, P.O. Box No. 180, Dublin.

Applicants are requested not to make enquiries at any of the Company's other offices.

The closing date for receipt of completed application forms is Friday 14 July, 1961.

**CANVASSING WILL DISQUALIFY**

**BRITISH**

## WIRE THREAD INSERTS

Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.

B.S.F. · Metric · B.S.P. · B.A.
Whitworth · Unified

**CROSS** MANUFACTURING CO. (1938) LTD
COMBE DOWN · BATH · SOMERSET
Phone: COMBE DOWN 2355[illegible] Grams: CIRCLE, BATH

## AIRCRAFT RADIO MAINTENANCE

**INTERNATIONAL AERADIO LIMITED**
invite applications from
**Aircraft Radio Maintenance Engineers**

for service in a number of overseas territories. Possession of ARME "A" and/or "B" licences is highly desirable but consideration will be given to candidates who have experience in the maintenance of aircraft radio, but who do not hold licences.

Staff overseas receive tax-free salary and allowances, free accommodation and medical attention, generous U.K. leave and numerous other benefits.

Written application, giving age, qualifications and experience should be made to the
**Personnel Manager, 40 Park Street, W.1.**

## VICKERS - ARMSTRONGS

**(SOUTH MARSTON) LIMITED**
**South Marston Works, SWINDON, WILTS.**

*are designing and building*

## HOVERCRAFT

**The Vehicle of the Future**

## QUALIFIED STRESSMEN

are required to co-operate in an expanding programme of Design and Development

Minimum requirements are H.N.C. and stressing experience.

**Apply to the Personnel Officer, as above**

## SITUATIONS VACANT

PEGASUS AIRLINES require experienced Viking Captains and First Officers at Gatwick and Blackpool bases. Highest rates paid for permanent engagements. Freelance contracts will also be considered. Apply to Chief Pilot, Gatwick Airport. [0482

VIKING Captains and First Officers required for Blackpool base. Apply: Chief Pilot, Pegasus Airlines, Squires Gate Airport, Blackpool. [0351

A & C LICENSED engineers experienced on light aircraft, required for overseas agricultural operations using American aircraft. Apply Crop Culture (Aerial) Ltd., Bembridge Airport, Isle of Wight. [0451

ENGINEERS holding A and/or C licence on DC.3 and 4, Bristol 170 and Viking aircraft required. Top rates paid to suitable applicants. Apply Channel Airways, Southend Airport, Essex. Telephone Rochford 56460. [0242

FLYING INSTRUCTOR at Exeter Airport. Good salary, Pension Fund. Apply to the Manager, Exeter Airport, Exeter. Tel.: Exeter 67433. [0250

**Aviation Traders (Eng) Ltd.,**

**A BRITISH UNITED AIRWAYS company**

**require:**

(1) A senior Aircraft Electrical Designer Draughtsman with H.N.C. (Electrical) and approximately 5 years' aircraft design experience.
(2) A senior Aircraft Loftsman preferably H.N.C. standard with a minimum of 5 years' Aircraft lofting experience for interesting work in Civil Aircraft Projects.

Apart from the normal superannuation and sickness benefit schemes, employees of this company enjoy the privilege of travelling by air on many routes at greatly reduced rates.

Apply in writing giving details of qualifications and experience and salary required to the

**Chief Designer,**
**Aviation Traders (Eng) Ltd.,**
**Southend Municipal Airport, Southend on Sea,**
**ESSEX**

[2368

APPLICATIONS are invited for the following vacancies at the company's present base at Biggin Hill for transfer later to Gatwick Airport when the new base is built.

R.A.E.'s covering multi-engined aircraft as inspectors, Must have Approved Inspection System experience.

ENGINE/AIRFRAME fitters.

AIRCRAFT electrical and radio engineers.

**AIR COURIERS LIMITED**
**BIGGIN HILL AERODROME,**
**BIGGIN HILL, KENT**

[2343

**PILOTS AND NAVIGATORS FOR AERIAL SURVEY**

Hunting Surveys Ltd., invites applications from men with the following qualifications:—

*PILOTS* A.L.T.P. Licence preferred. Minimum qualifications considered C.P.L. and I.R. (Group I Dakota). Preference given to applicants under 30.

*Navigators*
(a) Age under 30.
(b) Have completed a recognized course in air navigation.
(c) Knowledge of photography and modern navigational aids advantageous.

Both appointments involve overseas tours lasting up to 6 months in any year. Essential details only in the first instance to:—

**The Personnel Manager,**
**HUNTING SURVEYS LTD.**
**6 Elstree Way,**
**Boreham Wood, Herts.**

[2389

DERBY AIRWAYS have immediate vacancies for first and second officers on DC3. These posts are permanent and pensionable. Apply Chief Pilot, Derby Airport, Derby. Telephone Etwall 521. [2390

REQUIRED IMMEDIATELY. Licensed Radio Maintenance Engineer and Radio Mechanic. Apply Administration Assistant, British Aviation Services (Engineering) Ltd., Ferryfield Airport, Lydd. [2391

ENGINEER to take charge new department. Established organisation. Maintenance and C. of A. overhaul light types up to 1,200lb. Licensed A. & C. Others considered if experienced. Substantial salary with living accommodation. Permanent post. Apply Box No. 7246. [2399

THE SHUTTLEWORTH COLLECTION has a vacancy for a keen and experienced craftsman for repair and overhaul of light aeroplanes and veteran cars. Applications to Old Warden Aerodrome, Biggleswade, Bedfordshire. Tel. Northill 288. [2398

## SITUATIONS VACANT

AIRCRAFT ELECTRICIANS. Overseas Aviation Engineering (G.B.) Ltd., have vacancies for skilled aircraft electricians, to work on Viking, Ambassador and Argonaut aircraft. Experience on type not necessary, also for "A" licensed Radio Engineers, if possible Radar Endorsement. Apply: Overseas Aviation Engineering (G.B.) Ltd., Overseas Hangar, Gatwick Airport, Horley, Surrey. [2392

KUWAIT Air Force requires a Chief Flying Instructor with first class qualifications and experience for duty with Heron, Dove and Auster aircraft. Salary at rate of £3,000 with suitable increments. Initial contract for one year with annual extensions. Free fully furnished and equipped married accommodation and transport. Free medical facilities. Leave approximately 40 days annually with free air passages for employee and immediate family. There is no income tax on personal incomes in Kuwait.

Written applications should be addressed to Kuwait Agency, 40 Devonshire Street, London, W.1, giving details of nationality, age, qualifications and experience, together with names and addresses of three referees. Interviews will be held in London. [2393

LICENSED ENGINEER, A. and C. for Tiger Moth Aircraft. Good wages. Box No. 7243. [2394

## SITUATIONS WANTED

COMMERCIAL PILOT, 22, returning to U.K. from Canada early August requires flying position. 450 hours on most American light aircraft. Anything considered. All replies answered. Box No. 7245. [2396

C. P.L., 600 hours. R.A.F. trained, singles, twins, jets, airline experience, aged 22, must work or starve. Box No. 7242. [2397

## TUITION

AVIGATION LTD. provides full-time or postal tuition or a combination of these methods for M.T.C.A. pilot/navigator licences. Classroom instruction can be provided for A.R.B. General, certain specific types and performance schedule examinations. D4 Links, Ring RODney 8671. For details apply Avigation Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. EALing 8949. [0248

LEARN to fly, £32; Instructor's Licences and Instrument flying for £4 per hour. Night flying £5 per hour. Resident 6 guineas weekly. Specialized Course for Commercial Pilot's Licence. Wiltshire School of Flying Ltd., Thruxton Aerodrome (Andover Junction, 1 hour 15 minutes from Waterloo), Hants. [0253

## TUITION

DENHAM LINK TRAINING CENTRE. Cost per hour £1 or 18s. for block bookings. Tel.: Denham 2161 or 3171. [0295

SURREY AND KENT FLYING CLUB, Biggin Hill (BN9) 225. M. of A. approved course. Tiger and Hornet Moths, Chipmunk and Prentice. Contract rates. Route 705, one hour from Victoria. [0293

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL. Commercial and Private Pilots' training. Instructors' Courses, night flying every night. Rates from £4 (contract). No entrance fee or subscription. Municipal Airport, Southend-on-Sea. Rochford 56204. [0450

LONDON SCHOOL OF AIR NAVIGATION offers full-time personal coaching with Home Study Correspondence Courses or combination of both for all aspects of professional pilot and navigator qualifications, also PPL. Officially appointed Services Courses Scheme, 33 Ovington Square, Knightsbridge, London, S.W.3. KEN. 8221. [0510

A.F.R.Ae.S., A.R.B., Certs., A.M.I.Mech.E., etc., on "No Pass—No Fee" terms. Over 90% successes. For details of Exams and Courses in all Branches of Aeronautical work, Aero Engines, Mechanical Eng., etc., write for 148-page Handbook—free B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.8. [0707


# HIGH DENSITY SEATS

M 957 SERIES

**AS SUPPLIED TO PHILIPPINE AIRLINES AND THE INDIAN AIR FORCE**

- Double version weighed weight—37lbs
- Triple version weighed weight—52lbs
- Minimum pitch 30″
- Suitable for any aircraft with floor mountings
- Fold forward backs (recline optional)
- Tip-up seats
- Folding tables
- Removable or indexing legs.

RUMBOLD

L. A. RUMBOLD & CO. LTD. KILBURN · LONDON N.W.6 MAlda Vale 7366-7-8


## INDEX TO ADVERTISERS


| | Page |
|---|---|
| Adcola Products Ltd. | 14 |
| Aer Lingus | 19 |
| Airwork Services Ltd. | 14 |
| Alvis Ltd. | 8 |
| Associated Electrical Industries Ltd. | 5 |
| British Aircraft Corporation | Cover i |
| British European Airways | 17 |
| British United Airways | 17 |
| Canadair Ltd. | 7 |
| Central Office of Information (Royal Navy) | 10 |
| Clifford & Co. Ltd., Peter S. | 14 |
| Commonwealth of Australia | 18 |
| Cross Manufacturing Co. (1938) Ltd. | 14, 19 |
| Cunard Eagle Airways Ltd. | 18 |
| Dan Air (Engineering) Ltd. | 17 |
| Decca Radar Ltd. | Cover ii |
| Delaney Gallay Ltd. | 11 |
| Elliott Bros. (London) Ltd. | 2, 3 |
| European Aviation | 12 |
| Hawker Siddeley Aviation Ltd. | 6 |
| Iliffe Books Ltd. | Cover iii, 13 |
| International Aeradio Ltd. | 19 |
| Keegan Aviation Ltd. | 14 |
| Lockheed Precision Products | 16 |
| Miller Aviation Ltd. | 14 |
| Ministry of Aviation | 17 |
| "Motor Cycle, The" | 18 |
| Oxford Aviation Ltd. | 14 |
| Pressed Steel Company Ltd. | 17 |
| Rists Wires & Cables Ltd. | 1 |
| Rogers (Engineers) Ltd., W. H. & J. | 14 |
| Rolls-Royce Ltd. | 9 |
| Rudnick Helicopters Ltd. | 16 |
| Rumbold & Co. Ltd., L. A. | 20 |
| Sangamo Weston Ltd. | 13 |
| Shackleton (Aviation) Ltd., W. S. | 15 |
| Short Bros. & Harland Ltd. | 13, 14 |
| Simmonds Aerocessories Ltd. | 4 |
| Staravia Ltd. | 16 |
| Vickers-Armstrongs Ltd. | 19 |
| Vigors Aviation Ltd. | 14 |
| Westland Aircraft Ltd. | 16 |
| Wiggin Ltd., Henry | Cover iv |


Printed in Great Britain for the Publishers, ILIFFE TRANSPORT PUBLICATIONS LTD., Dorset House, Stamford Street, London, S.E.1, by THE GARDEN CITY PRESS LIMITED, Letchworth, Hertfordshire. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service Ltd., Gordon & Gotch Ltd. SOUTH AFRICA: Central News Agency Ltd.; Wm. Dawson & Sons (S.A.) Ltd. UNITED STATES: Eastern News Co., 306 West 11th Street, New York 14.

**Go Continental by Car**
Walter Hutton

Gives detailed information on everything a motorist needs to know when planning a motoring holiday in Europe. Hints on preparing the car, how to avoid the congested routes, mountaineering by car, winter sports and information on hotels and roads are a few of the subjects included.

**17s 6d net,** by post 18s.

**The Autocar Road Tests—Spring 1961**
By THE AUTOCAR technical staff

Illustrated reports on the performance of current British and foreign cars including small family cars, luxury saloons and enthusiasts' sporting models. Each report contains a description of the car's behaviour under varying conditions, numerous photographs and plans and a comprehensive table of technical information.

**6s 6d net,** by post 7s 2d.

**Car Driving As An Art** *second edition*
S. C. H. DAVIS of THE AUTOCAR

For advanced drivers as well as beginners. Does not merely explain how to drive, but covers the whole art of motoring. Driving in traffic, in fog, in rain and snow, on ice, foreign touring, dealing with passengers, luggage and caravans, and sports car performance are some of the subjects dealt with.

**12s 6d net,** by post 13s 6d.

**Caravanning and Camping for Motorists**
John Yoxall

Deals thoroughly with everything essential to the full enjoyment of mobile caravanning and motor camping. Covers such items as choosing a matched outfit; interior layout; design and construction; undercarriages; brakes and hitches; lighting and heating; water supply; sanitation; maintenance; caravanning abroad; tents and equipment; clubs; and legal matters.

**8s 6d net,** by post 9s 2d.

**Value-For-Money Motoring**
J. R. Davey

Specially designed to show the motorist how he can run his car at the lowest overall cost. Anybody without much technical knowlege can, by following the directions given, ensure greater reliability and longer life for his car, reduce his garage bills appreciably and save himself pounds.

**7s 6d net,** by post 8s 2d.

# books for the motorist

**Obtainable from all booksellers**

*Published for The Autocar by Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.*

The complete single-stage turbine unit of the Rover T.P. 90/1 is machined from a forged blank of NIMONIC 105 alloy. A pusher version of the engine is shown here with jet pipe venting above the power unit.

# ROVER'S 90hp TURBOPROP FLIES WITH NIMONIC 105*

## HIGH TEMPERATURE ALLOY

Smooth, quiet vibration-free power, simple handling characteristics, very little maintenance, exceptional overhaul life . . . these are outstanding features of the Rover T.P. 90/1, an interesting new small British gas-turbine developed specifically for light and ultra-light aircraft. It is a single-shaft turboprop arranged as a complete engine-change unit. Built by Rover Gas Turbines Ltd, it offers a continuous rating of 90 h.p. with 120 h.p. for take-off. Weight is approximately 100 lb. less with propeller, accessories and fittings, than for comparable piston engines.

The Rover 1S.60 industrial turbine from which the T.P. 90/1 has been developed, runs 1,000 hours between overhauls, and many 1S.60's have gone well above 3,000 hours! In the T.P.90/1 a NIMONIC 105 alloy bladed turbine permits higher peak temperatures—or alternatively will ensure longer life at the same peak temperatures than did earlier test engines.

NIMONIC 105 creep-resisting alloy provides exceptional high-temperature strength. This application is one of a number permitting improved performance in aero gas-turbines of advanced design.

* TRADE MARK

The 'Currie Wot' ultra-light biplane was the test-bed for an earlier 70 h.p. Rover turboprop. *Photo by courtesy of Flight*

**HENRY WIGGIN & CO LTD · WIGGIN STREET · BIRMINGHAM 16**

TGA 145